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Psychiatric Thought in Chinese Medicine*

ILZA VEITH**

ALMOST as proverbial as the handful of rice as sole means of subsistence for the Chinese coolie is the dictum that mental disease has always been relatively infrequent on the Chinese medical scene.[1] And in spite of the fact that notorious episodes of mass hysteria have periodically rent the peace of their country it is stated that the Chinese are a self-restrained and even phlegmatic race.[2] In this paper I shall neither attempt to verify nor to disprove the relative infrequency of mental disorders among the individual Chinese; rather, I shall try to analyze how such a belief could come into being. In the absence of comprehensive medical care, according to Western standards, extended over all of China, and health statistics based on an unvaried set of criteria, any such dictum must be based on individual impression and remain a generalization. Still, generalizations often contain a grain—or even many grains—of truth.

Western psychiatry entered Chinese medical thinking only very recently. The first mental hospital accommodating thirty patients was opened in 1897, in Canton; but although it grew into a 500-bed institution, it had to close its doors after only forty years of existence. The small number of additional mental hospitals which were founded in succeeding years fared little better, and in the course of the Pacific War almost all of them terminated their existence.[3]

In view of this late and scant acceptance of Western psychiatric endeavors in China it is of interest to study the earlier Chinese medical literature for traces of indigenous thought on mental

* Paper presented at the XIVth International Congress of the History of Medicine, at Rome and Salerno, September 1954.

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1 Andrew Woods: "The nervous diseases of the Chinese." *Arch. Neurol. Psychiat.* 1929, *21*, 542. This is one of many scientific articles where such statements are quoted. A good example for such statements in belletristic literature is the following: "There is almost no insanity among the Chinese now—almost none among those who have stayed at home and have given the treaty ports a wide berth. In the old days there was no insanity in all of China." Louise Jordan Miln: *Ruben and Ivy Sén*, New York, 1925, p. 100.

2 See Henri Maspero: *Mélanges posthumus sur les religions et l'histoire de la Chine*, Paris, 1950, pp. 163-169, for a movement of the Yellow Turbans (184 A.D.). Other such movements were the T'ai-p'ing rebellion and the Boxer uprising, and, to a lesser degree, the uprisings caused by the Red Eyebrows (25 A.D.) and the many other secret societies which were formed after the pattern of the Yellow Turbans.

3 K. C. Wong: "A short history of psychiatry and mental hygiene in China." *Chinese med. J.*, Jan.-Feb. 1950, *68*, 44-48.

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health and mental healing. It is also of interest to examine the structure of traditional Chinese society for reasons why psychiatry in the Western sense of the word was neither developed in China nor took hold after it was introduced there from the West.

The study of Chinese medical literature reveals an early awareness of the mind-body relationship and a profound understanding of what is now called psychosomatic medicine. There is relatively little mention of insanity, although it undoubtedly existed as is indicated by a number of ideographs denoting mental alienations. It is difficult, however, to determine—even from the context—whether these ideographs denote a permanent impairment of the mental faculties or a temporary derangement, possibly caused by fever delirium.[4]

According to the oldest Chinese medical writings any disease, but particularly mental disease, was caused by an imbalance of the two primary forces in man: the *Yin* and the *Yang*. These two forces which stand for the negative and the positive, the dark and the light, the moon and the sun, the noxious and the beneficial, also denote the female and male elements, both of which are ever-present in man and woman alike. Disease arises when the proportions of the two elements begin to vary from the normal.

This is not the place to go into detail about the fanciful variations that can be achieved by the two hypothetical forces, *Yin* and *Yang*. For the purpose of this paper it is important only to realize the strangely penetrating awareness of a bipolarity, a dual force, within every human being, a consciousness that within man there is something female, and something masculine within woman. Of greater significance is the alleged cause for the imbalance of *Yin* and *Yang*. This imbalance, it was believed, was caused by the patient himself who had committed a moral transgression by deviating from the prescribed way of nature and society. It was this concept of the "Way," known in Chinese as the *Tao,* which provided the guiding principle of all human conduct.

By means of these seemingly abstract theories, the ancient Chinese arrived at two extremely important conclusions: firstly, that disease is rarely localized, but generally affects the entire hu-

[4] The traditional characters referring to mental disease are: *tien* 癲 which can be translated as "mad, crazy, fits, convulsions"; *k'uang* 狂 "crazy, demented, wild, mad, cruel, violent"; *fêng* 瘋 "insanity"; and *fêng hsin* 風心 literally the "windy heart"; also meaning insane. More recently *ch'ing shên* 精神 (literally: animal spirits, vitality, energy, the spiritual part of man that has an existence apart from the body; the spirit of; the mental faculty) has been employed as a prefix for "psycho . . ."

man being; and, secondly, that disease is often associated with behavior, i.e. the infringement of a natural law. The following passages translated from the oldest Chinese medical book will illustrate these points:

> Just as the breath of the blue sky is calm so the will and the heart of those who are pure will be in peace, and the breath of Yang will be stable in those who keep themselves in harmony with nature. Those who fail to preserve good conduct will [find] . . . the breath of protection lost to them.
>
> Man's fear and apprehension, his passion and his suffering, his motion and his rest, they all cause changes [within the body and the mind].
>
> Those who act contrary to the laws of the four seasons . . . dissipate in their duties and if Yin is not equal to Yang, the pulse becomes weak and madness results.[5]

In spite of their antiquity—or rather because of it—the passages continued to be expressive of psychiatric thinking throughout the history of Chinese medicine proper and, in large areas of China, even after the arrival of Western psychiatric teaching. In order to appreciate this, we must be aware of the Chinese predilection for ancient authorities which helped to preserve their oldest medical classics as the basis of all subsequent medical thinking. While in the more recent centuries demoniacal possession, the spirit of vengeful ancestors, and similar superhuman phenomena have been credited with causing mental disease, this was believed by the unlearned and socially inferior persons only. Persons of education and social standing concurred in their theories on the origin of mental disease with the traditional view of the medical writers.

Unlike other cultures, the Chinese never personified a figure of a creator who might demand adoration and obedience and punish transgression. Instead they conceived of creation as having been accomplished by *Tao,* an impersonal force, which continued to exist as the physical and spiritual guide of the Universe and the individual. In the medical texts the spiritual requirements of the *Tao* were simply life in accord with the laws of nature; or, perhaps somewhat more concretely, the fulfillment of the requirements of the seasons. The philosophers, however, elaborated and specified the *Tao* and built around it an ethical superstructure that provided for all eventualities in life and for all essential types of interpersonal relationships. In doing so they still did not create a watchful and punishing god, but rather achieved a means for society to guide

[5] Ilza Veith: *The Yellow Emperor's classic of internal medicine,* Baltimore, 1949. Part II: "Translation."

itself and, more importantly even, for the individual to be the chief guardian and judge of his own conduct.[6]

Although all the so-called Confucian classics, including the writings of Mencius, could serve to illustrate this point, I shall restrict myself to a few quotations from the book on *Filial Piety* and the *Analects,* for they contain the essential maxims of Chinese conduct.

> Filial piety is the root of all virtue, and (the stem) out of which grows (all moral) teaching. (ch. I)
>
> In filial piety there is nothing greater than the reverential awe of one's father. In the reverential awe shown to one's father there is nothing greater than the making him the correlate of Heaven. (ch. IX)
>
> The service which a filial son does to his parents is as follows: in his general conduct to them, he manifests the utmost reverence; in his nourishing of them, his endeavor is to give them the utmost pleasure; when they are ill, he feels the greatest anxiety; in mourning for them, he exhibits every demonstration of grief; in sacrificing to them, he displays the utmost solemnity. (ch. X)
>
> Anciently, the intelligent kings served their fathers with filial piety, and therefore they served Heaven with intelligence; they served their mothers with filial piety, and therefore they served Earth with discrimination.
>
> Therefore even the Son of Heaven [the emperor] must have some whom he honors. . . . In the ancestral temple he manifests the utmost reverence . . . he cultivates his person and is careful of his conduct, fearing lest he should disgrace his predecessors. (ch. XVI)[7]

In the *Analects* we find the expression of very similar sentiments: "asked what constituted the superior man, the Master [Confucius] said: 'he acts before he speaks, and afterwards speaks according to his actions.' " (II:xiii) Confucius also said: "A youth, when at home, should be filial, and, abroad, respectful to his elders. He should be earnest and truthful and cultivate the friendship of the good." (I:iv) "The student of virtue has no contentions," (III:vii) for "filial piety and fraternal submission! Are they not the root of all benevolent actions." (I:ii)

Confucius also quoted other sages in corroboration of his own opinion. Thus it is stated in the *Analects*: "The Philosopher Tsang said: 'Let there be a careful attention to the performance of the funeral rites to parents, and let them be followed when long gone with the ceremonies of sacrifice; then the virtue of the people will resume its proper excellence.' " (I:ix)[8]

[6] For a more extensive discussion of Yin, Yang, and Tao in relation to medical thought, see Veith, *op. cit.,* pp. 10-18.

[7] The preceding quotations are taken from the *Hsiao King,* or "Classic of filial piety," in *The sacred books of the East,* ed. by F. Max Müller, Oxford, 1899, pp. 449-488.

[8] These quotations are taken from the *Confucian analects,* pp. 1-218, in vol. 1 of *The Chinese classics* by James Legge, Hongkong, London, 1861.

As has been shown in these Confucian writings, most of the veneration accorded in other cultures to a superhuman being, or beings, was in China devoted to the father, to the family, and, above all, to the ancestors. But this veneration went beyond service, tangible offerings and prayers; it entailed a moral conduct above the reproach of the living and the dead. Needless to say, this rigid, life-long obedience to the family hierarchy and the family honor must have imposed a severe psychological strain on many individuals. But so long as it was the standard of behavior among the majority of the people, it was accepted without question. This is borne out by a study of traditional Chinese literature: prose, poetry and drama alike, where any deviation from filial piety was treated with horror, shame, and perhaps occasional pity.

The devotion to family and ancestors was accompanied by another phenomenon which helped to guard the sanctity of irreproachable personal conduct. It is the concept of the "face,"[9] which had arisen as early as the 4th century B.C. Around it there developed a specific terminology, some of which has been taken over into other languages, though perhaps not with the full weight of its meaning. We are all familiar with the expressions "to lose face" and to "save face"; but we do not employ such terms as "to lose face for someone else," "to add to one's face," "to pad one's face," "to have no face" and all the other possible variations of this concept.

In the words of Hsien-chin Hu *"Lien"* (face) refers to the confidence of society in the moral character of ego. The concept of sin does not figure to any great extent in Chinese culture. . . . But the assumption of human nature as inherently good places on the individual the responsibility of training his character according to his own light and not the demands of his status.[10]

"Lien is both a social sanction for enforcing moral standards and an internalized sanction."[11]

It is no doubt true that the consistent public supervision of personal conduct has had a significant influence on the behavior pattern of the Chinese people, and it has certainly produced extreme sensitivity in some. The loss of face for the student who fails to pass his examination and the loss of face of the suitor who fails to win

[9] Hsien-chin Hu: "The Chinese concept of face." *Amer. Anthrop.*, 1944, *46*, 45-65; also in *Personal character and cultural milieu*, a collection of readings compiled by Douglas G. Haring, Syracuse University Press, 1949, pp. 409-429.

[10] Hu in Haring's "Collection," p. 425.

[11] *Ibid.*, p. 409.

his bride is almost irreparable. These and other defeats have led to extremely serious consequences. They have been contributing factors to acute psychoses[12] and have even led to suicide.[13] While students can do little to protect themselves from the trauma of failure in examinations, other situations make possible the employment of middlemen, who sound out the situation and prevent the voicing of a rejecting statement. For this reason the go-between in courtship and business is an important figure. On the whole, however, the intricacies of "face" are conducive to highly circumspect behavior; thus in many respects the concept of "face" removes frictions from interpersonal relationships which have tested the sensitivities of Western peoples.

I have gone to some length in describing the concepts of the *Tao,* filial piety and the "face," for they constitute the psychological foundations of the traditional Chinese personality. They do by no means negate or confirm the statement that insanity is scarce in China, but they do make for an emotional climate that was utterly alien and baffling to the non-Chinese observers who attempted to introduce Western psychiatry into that country. Their bafflement was most certainly increased by their lack of familiarity with the Chinese language which deprived them of direct communication and caused them to miss a great many symptoms. It is true that Western psychiatrists saw in the larger cities a number of raving maniacs who were locked in small cells and chained to the walls;[14] it is true that here and there they observed the wife of a coolie who believed herself transformed into a chicken or haunted by a disgruntled ancestor and gave a vivid presentation of her delusion.[15] But although there were rarely ever more than 1200 psychiatric beds for a population of 500 millions of Chinese,[16] this proportion never looked as blatantly inadequate as it would have in a Western country.

And yet, a number of recent statistical studies covering very small sectors of China disclose that the incidence of mental illness

12 P. M. Yap: "The mental illness of Hung Hsiu-ch'üan, leader of the Taiping rebellion." *Far east. Quart.,* 1954, *13,* 287-304.

13 Because it is considered offensive to the spirit of ancestral devotion, suicide is extremely rare in China.

14 Georg Schaltenbrand: "Psychiatrie in Peking," *Z. ges. Neurol. Psychiat.,* 1931, *137,* 170-175. See also Andrew Woods, *op. cit.,* p. 569.

15 Tsung-yi Lin: "A study of the incidence of mental disorder in Chinese and other cultures," *Psychiatry,* 1953, *16,* 322-323.

16 Schaltenbrand: *op. cit.,* p. 170.

is not negligible by any means.[17] Again it is the ancient moral and philosophical teachings that furnish the reasons for this seeming incongruity. Without the concept of sin and without the tradition of vengeful deities smiting mortals with the curse of madness, mental disease was never associated with religious guilt[18] nor was it apt to be the cause of family disgrace. Indeed, the Chinese, failing to observe the hereditary factor of this illness, often recommended marriage for therapeutic reasons. Thus, unlike his Western counterpart, the Chinese mental patient was never set apart from his accustomed surroundings.

These old practices which are rooted in the concept of filial piety and reinforced by the demands of "face" prevailed even after the opening of Western-type mental institutions; they account for the reluctance of the Chinese to commit family members to institutional care. Actually, filial piety imposes a dual obligation upon the family: firstly, the literal one, where the children feel obliged to honor their parents and to care for them, even if senile dementia or general paresis has transformed the patriarch into a burdensome and foolish old man. But the filial piety which is lavished upon the head of the household also protects and shelters the youngest and most distant member of the family. This was, of course, made easier by the fact that the traditional Chinese society was more tolerant than the Western world of mental borderline cases, idiocy, or various neurotic manifestations. It could afford this tolerance because the sprawling one-storied architecture of a Chinese country house permitted easy seclusion of a disturbed family member, and the agricultural society was able to find work even for the retarded and the deficient.

Whether the tremendous security emanating from the closely knit family system of Chinese society reduced the incidence of mental disturbances or simply hid them from view will never be known; nor will it ever be possible to gauge the amount of neuroses that may have been engendered by this concentrated and involved family life. It has been observed, however, that the removal from the family home into distant cities and even foreign countries has made the Chinese more vulnerable to mental disorders; although

17 Tsung-yi Lin: *op. cit.* deals with a regional study in Formosa: a study by B. Dai discusses the case histories of 2400 Peking patients in *Amer. soc. Rev.* (vol. 16, 1941). See also A. Kasamatu: "Ueber die vergleichend psychiatrische Untersuchung in einem Dorfe bei Cantong," *Psychiat. Neurol. Jap.*, 1942, *46*, 188-194; W. LaBarre: "Some observations on character structure in the Orient: the Chinese," parts 1 and 2; *Psychiatry*, 1946, *9*, 212-237, 375-395.

18 See J. J. L. Duyvendak's review of Henri Maspero's *Mélanges posthumes, T'oung Pao*, 1951, vol. 40, p. 374.

even there they take with them the precepts of filial piety and the requirements of "face." But the sensitivity engendered by the latter is apt to cause tensions in strange and foreign surroundings, and the absence of an immediate object for filial piety may produce an emotional void and heighten the feeling of loneliness.

This is particularly true for temporary residents of Western countries such as students, whose life is spent in close association and competition with non-Chinese.[19] Among the "overseas" Chinese, on the other hand, where the traditional pattern of family and community life is in full operation, the relative percentage of recorded mental disease is appreciably lower than that of any other racial group.[20]

Of course, these findings may be partly due to the fact that "overseas Chinese," like those of the mainland, have less sharply defined notions of normal and deviant behavior than those held by peoples of Western extraction, and that the type of mental disease brought to the attention of the physician is only that which cannot possibly be managed in the home. Yet, regardless of the underlying reasons, it becomes clear that the Western observation on the relative stability of Chinese mental health contained more than one grain of truth. But we also see that, far from being the result of specific racial qualities, this apparent stability is closely linked with the ancient ethical and social precepts of the Chinese.

The severe rationality of Confucianism may have stifled much personal initiative and left unsatisfied a great many impulses and desires. To the less enterprising, however, the tight framework of Confucian ethics coupled with the rituals contained in the Chinese social structure must have been eminently comforting. By channeling human conduct along a minutely prescribed "Way," by holding up self-respect and equanimity as the most desirable attributes, and by making family ties indissoluble beyond death, social philosophy succeeded in creating a standard of behavior and an emotional climate of such repose and security for the individual that it remained effective for two and a half millenia.

19 P. M. Yap: "Mental diseases peculiar to certain cultures: a survey of comparative psychiatry," *J. ment. Sci.*, 1951, *407*, 326; also S. K. Chou and C. Mi: "Relative neurotic tendency of Chinese and American students," *J. soc. Psychol.*, 1937, *8*, 155-184.

20 According to the new registration of mental cases by race, arranged by the Bureau of Mental Hygiene of the Board of Health of Hawaii, for the years 1947, 1948, and 1949, the mental disease rates for whites was double that for the Chinese. Francis L. K. Hsü: *Americans and Chinese: two ways of life*, New York, 1953, pp. 61-65.

Robert Knox's Catalogue

JAMES A. ROSS* AND HUGH W. Y. TAYLOR**

As the four hundred and fiftieth anniversary of the Royal College of Surgeons of Edinburgh approaches, a retrospective view, even to the least historically minded, cannot fail to find something of interest in the long panorama of events which fill the span of those four and a half centuries.

The names of many great men who have worked in Edinburgh since 1505, the date of the founding of the Royal College of Surgeons, are still remembered and venerated by the present generation; but time has dealt with the reputation of others, held in the highest esteem by their contemporaries, as effectively as a Lytton Strachey. One name, however, still appears to exert its peculiar fascination down the "arches of the years"—the name of the eminent anatomist and first Curator of the Museum of the Royal College of Surgeons of Edinburgh, Robert Knox.

The details of Robert Knox's career are sufficiently well known. His name has recently been before the public in the person of Alistair Sim, acting Knox's part in *The Anatomist*, Bridie's famous play. The notoriety which is attached to him through his association with the Burke and Hare murders has overshadowed his fame as a scientist and a teacher. The Doctor's watch-chains, jewels, and waistcoats, described in the vivid and oft-quoted pen-portrait of his biographer Lonsdale, have done more harm to his reputation among modern scientific critics than the invectives of Christopher North in the pages of *Blackwood's Magazine* in his own times. The opinion is expressed that he was a charlatan; and though Guthrie observes that it is both unfortunate and unfair that Robert Knox should be remembered mainly in relation to the Burke and Hare affair, his character is often regarded as equivocal or enigmatic.

It is not the purpose of this paper to enter into a controversy on this subject, but to present some evidence which we believe to be new and which throws some fresh light on the character of this remarkable man. This evidence is a large manuscript catalogue in the Anatomy Department of Edinburgh University.

The manuscript is a book bound in cardboard and leather, 13 by 8 inches with 132 leaves, and has the outward appearance of an

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ordinary ledger. The watermark of the paper is a beautiful thistle and crown with the maker's name, J. Whatman, below, and the date 1827. In the middle of the inner side of the front cover there is a white card pasted on, with the name "The Rev. I. T. Goodsir, F.R.S.E." in print. On the same sheet higher up is an entry in ink, "This catalogue is in the handwriting of Mr. Frederick Knox." The writing of this entry is not unlike that of Professor Sir William Turner.

These entries show that the book came into the possession of Professor Goodsir of the Chair of Anatomy, Edinburgh University, 1846-67, the pupil and friend of Robert Knox, and that it then belonged to one of his relatives, the Reverend T. Goodsir, who donated it to the Anatomy Department of the University. It cannot be linked with previous catalogues belonging to the Anatomy Department and precedes the *Catalogue of Anatomical Preparations Illustrative of the Whale,* published in 1838 and described in chapter IX of Lonsdale's biography. It has evidently been laid aside and forgotten for many years.

The pages have been ruled down the middle to leave a margin almost half the width of the page. Starting at one end, the book is seen to be mainly a catalogue of museum specimens kept by Frederick Knox, the brother of Robert Knox and his assistant at his Anatomy School. This "Catalogue of the Museum" must refer to Robert's own private collection as there is an entry later in the book with the heading "Specimens removed in 1828" referring apparently to the handing over of Dr. Barclay's collection, which Robert Knox had inherited, to the College of Surgeons.

Taking the comparative anatomy entries first, there are in all 696 entries extending over most of the book. They are made in meticulously neat handwriting in clearly legible though now faded ink, and signed and dated in many places with Frederick Knox's name, e.g. "Frederick Knox 20 Sept. 1836." This date, at Entry No. 689, is the latest date recorded in this series, though at No. 685 an extra note has been inserted dated 30 March 1839. In many places there are pencil marks, crosses and lines, and additional notes in the wide margin opposite important entries. The catalogue covers a wide range of specimens of comparative anatomy and human pathology. Many entries are of considerable interest, since brief descriptions are added with details as to where and when they were obtained. Numerous skeletons of smaller animals, fish, and snakes are listed, most of these having been obtained from the neighbourhood of Edinburgh—the Forth, Fisherrow, the Lammer-

muir Hills. The pathological specimens were obtained from the Royal Infirmary. Crania of the larger mammalia, preparations of the eye in different species, and a collection of human urinary calculi are also recorded. At No. 37 is the entry, "Skeleton of a wild cat (Scotland) presented to Dr. Knox by Lord Glenorchy whilst a pupil at his class," and No. 38 reads "Skeleton of the female wild cat, Do." Lord Glenorchy also presented a skeleton of an Alpine Hare (No. 48). At No. 547 there is an inset as follows: "Mr. Brunel's new plan of tunnelling is founded on the observation of the operations of the Teredo (the calamitas navium of Linneus). The tunnel under the River Thames would have been totally impracticable without adapting the system of the shield and indeed the whole *modus operandi* of the Teredo a small testaceous insect!!!" At No. 568, the "Skeleton of the Creyfish," there is another illustrative remark, "Mr. Watt invented his flexible water-main or pipe from observing the construction of the tail of the lobster."

At the other end of the book, on both sides of the leaf to start with and thereafter on the other side of the leaf to Frederick Knox's catalogue entries, another series of entries is found in different handwriting. This somewhat confusing method of recording notes and memoranda is mentioned by Lonsdale as having been employed frequently by Robert Knox. The first entry, occupying the first three pages, records a pathological specimen. It is a very careful description of a compound dislocation of the knee backwards, obtained from an amputation, and is accompanied by two ink sketches (Figs. 1 and 2).

At the top of page 4 appears the title, "Anatomical and Pathological Appearances met with in the Dissecting Room during the Winter Session of 1827-8" (Fig. 3). Thereafter follows a series of entries on both sides of the leaf, each of which is numbered, to page 17. On pages 16 and 17 the initials "R.K." appear. Pages 18-21 have further entries in similar handwriting, not initialled, and the entries in this handwriting, apart from a single note described later, thereafter cease.

The entries on pages 4 to 17 cover an anatomical field of perennial interest. The first, on page 4, is a short, careful description of a human anatomical variation, a biceps brachii with three distinct heads. No. 2 is an imperfect entry, "a remarkable tumour . . . more fully described afterwards." Nos. 3, 4, and 5 are anatomical entries, giving brief descriptions of unusual findings, No. 3, a unilateral psoas minor. No. 4, the "Extensor proprius pollicis pedis (ex-

tensor hallucis longus) sent a small separate tendon to the first phalanx of the great toe. This occurred on both sides." No. 5, "From the superior and inferior part of the plexus two branches were given which uniting about the middle arm formed the median nerve. . . ."

The next two entries deal with pathological specimens; notes on a case of ruptured uterus (No. 6) and an unhealthy, dry, shrivelled and contracted synovial bursa over the greater trochanter (No. 7). No. 8 is a most interesting entry, a description of a left kidney with two ureters, and is illustrated by a pen and ink sketch (Fig. 4). It reads as follows: "There were two ureters present proceeding from the left kidney after passing for about three inches downwards from their origin they formed one trunk which passed into the bladder as usual—see sketch. In this subject all the arteries were more or less ossified." Knox refers to this variation in his *Manual of Human Anatomy,* "It sometimes happens that . . . pelvis and ureter remain double to near the entrance of the latter into the bladder."

In No. 9 an abnormal muscle is described, a biceps with three heads having "precisely the appearances" as in No. 1. No. 10 gives a full account of an axillary arch as follows: "Across the axilla in both arms there was a distinct muscular slip passed from the Latissimus Dorsi to the Pectoralis Major. It arose by a fleshy origin of the breadth of half an inch from the Latissimus Dorsi and ended in the Pectoralis Major where it is about to pass into its insertion by a beautifully rounded tendon. This muscular slip was pyramidal."

In No. 11 a loose body in the elbow joint of a "stout young subject" is described and a full note follows on a "variety in the distribution of the descendens noni nerve" (descendens hypoglossi) accompanied with a sketch (Fig. 5). No. 12 is another brief note on an anatomical variant, a right subclavius muscle inserted into the root of the coracoid process. Nos. 13 and 14 are descriptions of diseased hip and knee joints encountered in anatomical subjects in the course of dissection, and No. 15 is a note on an inguinal hernia found in a dissection room specimen.

No. 16 records "in a male subject of about 13 or 14 years of age, the left vertebral artery was found arising from the arch of the aorta." An unusual branch of the internal mammary artery is also described. No. 17 is a very full account of a trachea and larynx in an old male subject, with a hernia of the mucous membrane through an opening between the cricoid cartilage and the first ring of the trachea, accompanied by a life-size sketch of the larynx

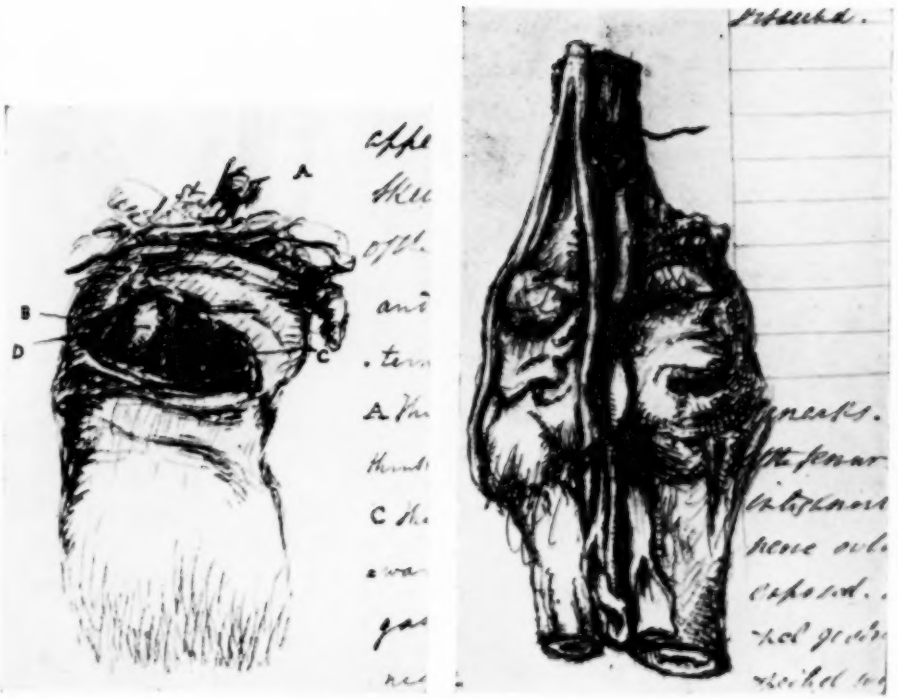

FIG. 1. One of two ink sketches illustrating case of compound dislocation of knee joint backwards. The sketch represents condition of joint before dissection and appearance of external wound. "A. Thigh bone. B. Its external condyle thrust through the integuments."

FIG. 2. The second of two ink sketches representing the joint dissected.

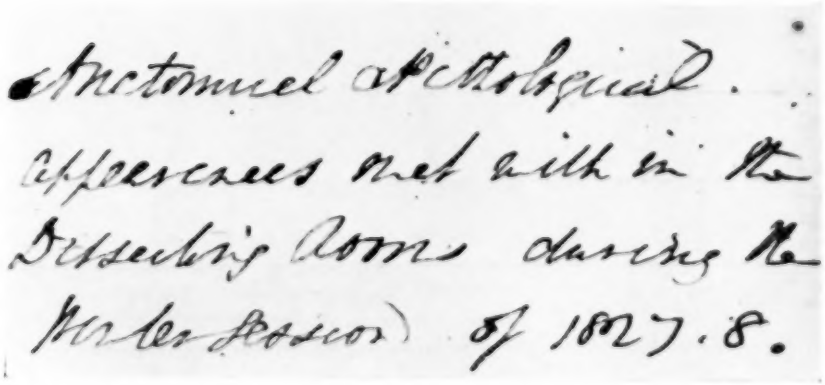

FIG. 3. Title, on page 4 of the Catalogue, preceding the anatomical entries. Both title and entries were made in Robert Knox's writing. Note the date 1827-8.

FIG. 4. Ink drawing illustrating entry No. 8: left kidney with double ureter.

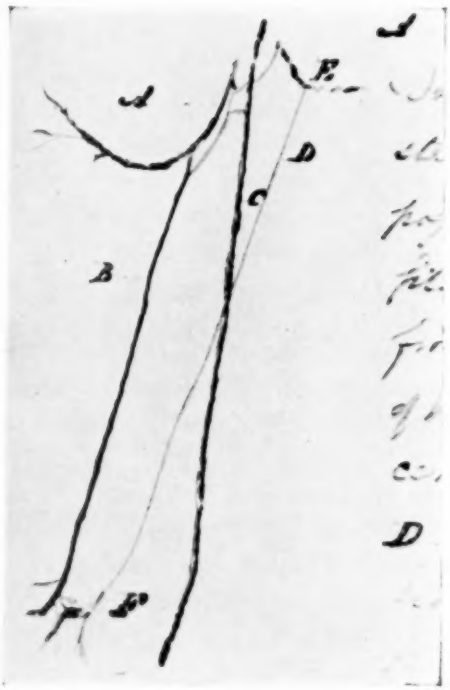

FIG. 5. Drawing accompanying entry No. 11 entitled "Variety in the distribution of the Descendens Noni." The explanatory text slightly modified reads "A. Hypoglossal Nerve. B. Descendens noni which, instead of arising from the Hypoglossal merely, sends two small filaments to it in its ascent from the plexus at the root of the neck to join E. the second cervical. C. Par Vagum. D. Descending branch of the second cervical E, forming with the descendens noni a plexus F, supplying the stern hyoid and thyroid muscles—the omo hyoid, etc. etc. . . ."

FIG. 6. Drawing illustrating entry No. 17, "Case of Remarkable Opening in the Trachea" between cricoid cartilage and first ring of trachea.

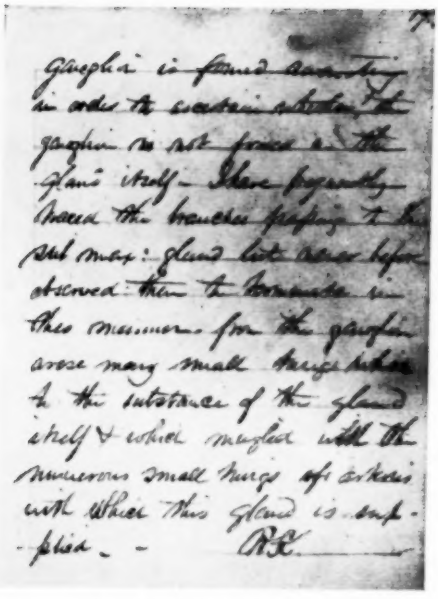

FIG. 7. Further entry made at No. 17, submitted as typical example of Knox's handwriting and also showing his initials "R.K." (x ½)

and trachea (Fig. 6). On the same cadaver an unusual submaxillary ganglion is noted and described (Fig. 7).

No. 18, the final entry, occupies pages 18-21. "A lad of apparently about 14 years of age came into the rooms at the end of the winter session 1829-30. The whole body was very much emaciated and the lower extremities were much distorted from disease." A description of the diseased bones follows which gives the picture of osteomyelitis of the left tibia.

It will be seen, therefore, that the foregoing is a series of unsystematic entries evidently jotted down whenever the writer made his observations in the dissecting rooms, recording them for future reference and elaboration. The writing is larger and not as neat as Frederick's; some of the words are scored out, suggesting that the entries were made directly, sometimes in haste. Nevertheless, these private memoranda are models of vivid description, and reveal the hand of a master. Muscular, vascular, nervous, and renal abnormalities have been noted, and pathological features as well as anatomical findings are described. The initials "R.K." attract particular attention as they confirm the impression already gained by the character of the entries that they are by the anatomist himself; and the date 1827-28 is momentous.

Further on in the book on the same side of the leaf as the entries under "R.K." but in different handwriting to either of the Knoxes is a heading "Preparations in Comparative Anatomy removed from Dr. Knox's premises Sept. 1828." This is followed by a list of 120 specimens with no descriptive details. Our inference, mentioned above, is that these were specimens acquired when Robert Knox took over Dr. Barclay's school and were now handed over to the College of Surgeons.

Following this list there is another heading "Museum of Human Anatomy 23rd September 1828" in the same writing as the preceding. Then follows, for six pages, a list of specimens. These include "14 complete crania considered as European. 1 of a native of Van Dieman's Land. 1 Peruvian. 1 Caffre." Sections of skulls; portion of a cranium removed from a field of battle in the West of Scotland; femora, pelves, bones of the shoulder girdle; some specimens showing disease—fractures, caries, exostoses, necrosis—are tabulated. "Specimen showing the effect of tight shoes and the origin of bunyons"; "Skeleton suspended in the Class Room"; "D/o in the Dissecting Room," are further entries.

After these six pages there are three pages all filled in with the writing of Frederick Knox's catalogue. Then follows a heading in

the margin, "Vascular and other preparations" followed by five pages of entries. The first two and a half pages of these are records of vascular and muscular preparations. "Section of corpus cavernosum penis inflated and dried." . . . "Preparation of a crural hernia with the obturator artery surrounding the neck of the sac." . . . "Vascular head and thorax." . . . "Preparation of an aneurysm of the aorta." . . . "Vascular foot." . . . "Caput caecum coli of the foetus." . . .

The last two and a half pages of this group are largely occupied by a series of numbers evidently referring to specimens in the museum, not described in the catalogue. Some have Roman numerals. There are a few descriptive notes among this list of numbers, some of interest. "Preparation of the internal ear (from Dr. Sharpey)." . . . "Perforated ensiform cartilage." . . . "Specimen of the human foetus (presented by Dr. Adams)." This list ends with the entry "Specimen of fractured neck of the femur—in spirits—." This is in different writing from that of the compiler of the rest of the list, but readers of the notebook readily recognize it as that of "R.K."

The book, therefore, is completely full. The last entry on Frederick Knox's list, No. 696, comes up to the line below the end of the last entry on page 21, the case of necrosis of bone in a lad of fourteen.

This book, then, written a century and a quarter ago, and disregarded for many years, comes under scrutiny again. It does not possess any particular intrinsic anatomical value, perhaps, but as an historical document it cannot fail to have some significance, particularly to those interested in the history of anatomy and the Edinburgh Medical School.

It confirms in many details statements made by Lonsdale in his biography; the profound interest Robert Knox took in comparative anatomy and his keen powers of observation of anything new or unusual are fully displayed here. In its headings and brief details lies the germ of many scientific papers which Knox was to write in future years. The date of the earlier entries, 1827-28, initialled "R.K.," record observations made on dissections of bodies which almost certainly had been the victims of Burke and Hare. It was on 2 November 1828 that the body of a murdered woman was found in Knox's dissecting room. At the trial of Burke and Hare it was ascertained that of the persons murdered thirteen had been taken to Dr. Knox's school.

An accurate comparison of the entries with details of Burke's examination at his trial is not possible as the "subjects" are not fully described in the catalogue. It is significant that this particular series of entries ceases suddenly after 1828, the rest of the book being largely filled with the later comparative anatomy and pathology entries. It may well be that Knox was unable to obtain human subjects following the exposure of the criminals who had supplied him. The inference may be drawn also that the anatomist, profoundly upset by the Burke and Hare affair, ceased his dissections and note-taking on human anatomy for the time and devoted himself to comparative anatomy.

We feel that this manuscript has added some evidence which must be taken into account when the character of the anatomist is assessed. A melodramatic atmosphere clings to his name and obscures the appraisal of his real standing. An examination of the catalogue, and the annotations compiled for his private use, show that a solid amount of work had been accomplished, a number of interesting human anatomical variations had been described, and a large collection of various specimens had been made.

A number of questions arise—sidelines of medical history—which could be pursued. What has happened to the specimens described in the catalogue? There are a number of Knox's specimens in the Anatomy Museum of the University at present, including the well-known cervical rib collection, but, as far as we have been able to ascertain, there are none of the specimens listed in the catalogue we are describing. Were other catalogues kept? Or did Knox lose his zest for a time after his shattering experiences in 1828-29 and cease from painstaking, regular note-taking, keeping his memoranda "on small pieces of paper and in a most perplexing manner on both sides of the sheet" as Lonsdale describes? It is certain that the manuscript contains the work of a competent scientist; and the abrupt breaking off of the entries on human anatomy so promisingly begun bears silent testimony, in our opinion, to the tragic interruption of a brilliant career.

A careful appraisal of Knox's character, made by an impartial observer uninfluenced by the distorting elements of contemporary passions and controversies, would furnish a fascinating study for a medical historian. A discussion on this subject, however, would entail reference to additional authorities not quoted in the present paper, and it is not our intention to elaborate this theme. The description of the catalogue simply endeavours to illustrate one particular facet of the complex picture—Knox's genuine scientific

attainments; and we hope that a future critic of the anatomist will not pass by the evidence displayed in his catalogue's faded pages.

Today, when the anatomy course for medical students is under criticism, it may be well to remember the position which Robert Knox gave to the subject in his own times: "To the question frequently put as to the utility of minute anatomy, I reply that this invaluable knowledge will enable you to reject many idle speculations in physiology and pathology daily offered you; by it you may at least check, if not destroy, empiricism and combat rash surgery, come from whom it may. It is, in brief, the only torch which Medicine possesses to guide her on the obscure experimental, conjectural course she seems doomed to follow."

ACKNOWLEDGMENTS

We wish to thank Professor G. J. Romanes for permission to use Knox's catalogue and for encouragement in the production of this article. We also thank Mr. John Borthwick of the Anatomy Department of the University of Edinburgh for the photographs.

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Observations on the History of Goiter in Ohio and in West Virginia*

ISIDOR GREENWALD**

THE present paper is one of a series of studies on the history of goiter[1-5] in all of which it was found that, in many different parts of the world, goiter is a relatively new disease and that its incidence has fluctuated greatly from decade to decade. These facts contradict the currently accepted "iodine-lack" hypothesis. Some of the evidence adduced in support of this hypothesis has been examined and criticized in other publications.[6-7]

The "iodine-lack" hypothesis, which had fallen into disrepute, owes its revival in the twentieth century largely to the work of Marine and his associates[8-9] which was done in Cleveland and Akron. Because of the importance of the high incidence of goiter in these cities in the history of the development of our ideas concerning the cause of endemic goiter, it seemed advisable to study the history of goiter in Ohio, particularly along the shore of Lake Erie.

The first reference to the occurrence of goiter within the confines of the present state of Ohio that I have found is in two letters, dated 2 December 1797 and 13 January 1798, from John Heckewelder, at Bethlehem, Pennsylvania, to B. S. Barton, and quoted by the latter in his *Memoir Concerning Goiter*.[10] This was "among the Indians, living on Big-Beaver-Creek, and on the river Muskingum. It was principally confined to "women and girls." "With some [says he] as they grew up, the complaint increased; with others (especially where a remedy was applied) it wore away again, though there are few that think much of it." "In the summer of 1797, I saw," says Mr. Heckewelder, "two women, whom I knew when girls at the age of ten or twelve years, and in whom this swelling had then begun; now (1797) with such necks that it surprized me. This swelling with one projected even before her chin. I asked one of them, whether she had never made use of any remedy to cure her. She said, she had applied burnt and powdered muscle-shells, but to no effect. She felt no pain, she said; and was the mother of two children."

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The Moravian mission on the Big Beaver was moved to Schönbrunn on the Tuscarawas in Ohio in 1773[11] and this, in turn, was abandoned in 1777.[12] Many of the Indians accompanied the missionaries in their moves and it is possible that some of the goiters seen on the Big Beaver, necessarily in or before 1773, were in the two "girls at the age of ten or twelve years" who became the women seen on the Muskingum in 1797. Since goiter was prevalent in the vicinity of the Big Beaver in Pennsylvania in 1798 and 1810 (see pages 277 and 279), it is interesting to speculate that these girls and their companions may have introduced goiter into Ohio.

However, goiter could scarcely have been very prevalent or very serious among the Indians or among the Moravians either in New York (before 1766) or in Ohio. Mahr[12] did not encounter any mention of it in his examination of the mission diaries of Schönbrunn and, in a letter dated 23 December 1951, wrote: " I can state with a reasonable degree of certainty that goiter was no problem for the Moravian missionaries in their Indian Mission stations, in Ohio, between 1772 and 1804."

I did not find the disorder mentioned in the *Moravian Journals Relating to Central New York, 1745-1766,*[13] nor by Loskiel,[14] Heckewelder,[15] or Zeisberger[16] in their respective histories, nor by the last-named in his diary.[17] However, in his dictionary, Zeisberger[18] gave a Delaware equivalent "Knōp" for the English "wen" and German "Kropf." There was no equivalent in Onondaga, presumably because Zeisberger did not see goiter among the Indians in New York, but only among the Delawares in Pennsylvania or in Ohio. The word the Delawares used is obviously related to the German "Kropf" and indicates quite strongly that the disorder was not known to the Indians before the arrival of the Moravian missionaries.

Barton also quoted from a letter from Dr. George Stevenson of Pittsburgh dated 4 January 1798: "Cases of goitre are met with among the inhabitants on the waters of the Allegheny and French-Creek, and at Sandusky; a few instances on Monongahela, and at this place, where, out of 1400 inhabitants, there are not less than 150 persons who have it."

In a note on page 54, Barton added: "Since the preceding pages were printed off, I have been informed that the goitre is a common complaint among the Shawnee Indians residing on Scioto, a considerable river which empties itself into the Ohio below the mouth of the Muskingum."

The references to Sandusky and the Scioto river are interesting. According to Downes[19,20] the Delaware Indians had migrated to Sandusky in 1781, although they continued to hunt in other places, including the area along the Scioto river. Possibly they were responsible for introducing goiter into both of these regions.

Before Lewis and Clark set out on their famous exploration of the newly purchased Louisiana Territory, Jefferson sent Lewis to Benjamin Rush to learn a little medicine. In Jefferson's instructions to Lewis, before the latter's departure, Jefferson enjoined him to record the names, number, and characteristics of the Indian tribes, including "the diseases prevalent among them and the remedies they use."[21]

Several members of the expedition kept diaries. In the Journals of Captain Lewis, we may read:[22] ". . . was here [Ohio River, a short distance below Marietta] informed that there were some instances of the goitre in the neighborhood; two women who lived on the bank of the river just below [said] they had emigrated to that place from the lower part of Pennsylvania and had contracted the disease since there [*sic*] residence on the Ohio." There is no other mention of goiter in any of the diaries and it is not clear on which side of the Ohio the two women lived.

Not many years later, in 1810, Nuttall[23] travelled through Pennsylvania—from Philadelphia by coach to Pittsburgh and then on foot to Erie. From there, still on foot, he proceeded to Sandusky Bay and then by boat to Detroit. He kept a diary and made entries almost daily. He was a friend of Barton, who paid his expenses. Barton also gave him explicit instructions including (pages 77 and 78): "From Pitt, proceed by the route which shall be recommended to you to Sandusky . . . proceed, by the nearest way to Sandusky, where I wish you to stay at least so long as to acquire five good specimens of the Wyandot-language. Here, also, you may expect to find some curious plants; and dont omit to make inquiries about the disease of Goitre; its comparative frequency in males and females; whether it is often connected with fatuity, &c. . . . From Sandusky, proceed to Detroit . . ."

Nuttall did not wait until he reached Sandusky. He seems to have made inquiries regarding the diseases of the country at various places. At any rate, at Butler, Pennsylvania, he wrote (p. 31): "On entering into conversation respecting the diseases of the country, he informs me, that 'the *Goitre* is decreasing tho' the population is rapidly increasing'. . . . Mr. Collins told me 'he knew

a young woman cured of it by taking some preparation of *sponge!* but that before she was recovered this medicine reduced her almost to a skeleton' [case of "Jod-Basedow"?]."

Nuttall did not go to Sandusky (now Fremont, see reference 23, p. 53) because, as he wrote (pp. 52-53): "This evening I came to a small settlement on *Huron* river where a boat was hourly expected which was going to *Detroit*. *Sandusky* is 35 miles from this place; so that it was impracticable to go thither & back without missing the boat, and from *Sandusky* to *Detroit* the road lies thro' an almost desolate wilderness of 150 miles, for passing thro' which I was not yet prepared." He did, however, go as far as Sandusky Bay before returning to Huron to board the boat for Detroit.

Considering his explicit instructions, it is rather remarkable that he did not record the results of any inquiries regarding goiter in this vicinty. However, if there was any goiter at Sandusky (Fremont), it must have been quite peculiar to that locality, for in Detroit he wrote (p. 59): "The water of the lakes is perhaps as pure & generally wholesome as any body of fresh water in the world, & the inhabitants of their banks generally speaking are as healthy or rather more so than in any other part of America, & by no means peculiarly afflicted with *Goitre*." He also wrote (p. 59):

> The disease of *Bronchocele* or *Goitre* is very prevalent in Detroit & its neighbourhood, both among whites and Indians. The female sex is much more subject to it than the male, & there are few white women who have not experienced more or less of it. It is sometimes tho' rarely accompanied with fatuity. I saw one instance of this in an Indian man, a poor harmless idiot! It is more distressing to some individuals than others. Many carry about this disease for years without much apparent inconvenience, while others are threatened with suffocation & death.

The goiter seen by Lewis a short distance below Marietta in 1803 did not promptly become general in that vicinity for in 1809 Hildreth, at Marietta, stated: "The only endemick I am acquainted with is ophthalmia membr."[24] Nor was it present further down the Ohio for in 1810 Daniel Drake, in Cincinnati, wrote: "Goitre is an endemic of some of the N.E. portions of this State, but is not known here."[25]

Goitre came to occupy more of Drake's attention. In 1815, again from Cincinnati, "The *Goitre* is an endemic of the western portion of Pennsylvania, and the eastern part of this state, but it is unknown here, except in persons who have immigrated while laboring under it."[26]

By 1829 he was enthusiastic about the use of iodine. "Who could have foretold that scrofula and goitre would disappear before the influence of iodine, or syphilis yield to the action of mercury."[27] However, it is not clear whether this was due to his own observations or to his reading of the literature. His subsequent remarks (see below) suggest the latter.

Whatever the cause may have been, the incidence of goiter was diminishing. In 1832, Drake wrote, "Goitre, or 'swelled neck' once prevailed on the upper waters of the Ohio, particularly in and about Pittsburg, but has nearly disappeared."[28] However, by 1842 there had been a change. Drake had observed or had been told of an increasing frequency of goiter in northern Ohio and in the valley of the Scioto.

> Twelve months ago, we were wandering along the northern extremity of the Ohio and Erie canal, as we are now upon its southern. We there saw a number of cases of goitre, and heard of many more. Not a few of them were in their first stages, and the testimony of the physicians with whom we conversed, went to show that the malady is decidedly increasing in frequency. Indeed, within the last four or five years, the cases in the valley of the Scioto have greatly multiplied. The patients are nearly all women in early life. Our brethren treat the disease with iodine, administered without and within; and, in general, speak encouragingly of its effects.[29]

The high enthusiasm of 1829 had waned during the ensuing fourteen years.

Additional evidence for the continued presence of goiter in the valleys of the Scioto and Cuyahoga, as well as "among the upper waters of the Kanawha," is to be found in a letter Drake wrote at Wytheville, Virginia, 16 July 1850. "Goitre. Cases are scattered here and there. I think they are not more numerous, in proportion to the population, than in the valleys of the Scioto and Cuyahoga."[30]

In 1843 Drake[29] had appealed to his colleagues to send him information regarding goiter. "On the remote causes of this malady, we shall not venture this muggy afternoon to offer any speculations; but in place of them, will respectfully solicit, from all who may read this article, whatever facts they can give us concerning the disease, and the geographical conditions under which, anywhere in the west, they have observed it to occur." Nevertheless, examination of the files of the *Western Journal of Medicine and Surgery* until its suspension twelve years later (1855) disclosed no mention of goiter, except in a notice of a book on New Zealand.

Noteworthy over these forty-six years, 1810 to 1855, is the complete absence of any reference to goiter in Cincinnati, except among

those who brought it with them. In 1924, 38 per cent of the boys and 57 per cent of the girls were said to have goiter![31]

There is a paucity of information regarding the situation in Ohio for a period of more than thirty years. That there was a certain academic interest in goiter early in the 1840's is evidenced by a broadside, "A complete compendium of Eberle's medical practice prepared by Hardy Wallace Hill, Professor of Anatomy in the Botanico-Medical College of Ohio,"* in which the last of 125 disorders is "Bronchocele, goiter" for which "iodine, burnt sponge, calcined eggshells, etc." are recommended. The date is not given but, since the fourth edition of the *United States Dispensary* (1839) is mentioned, it is probable that the broadside was published between that date and 1843 when the fifth edition appeared. However, the inclusion of goiter in this broadside may have been due entirely to its mention in Eberle's book and not at all to its occurrence in Ohio. The first edition of the *Treatise on the Practice of Medicine* appeared in 1830 and referred to the prevalence of goiter in various places in Europe, in six places in Vermont, six in New York, others in Pennsylvania and (West) Virginia, but to none in Ohio. This remained unchanged in subsequent editions, although Eberle lived in Cincinnati from 1831 to 1837 and, for a year thereafter, in Lexington, Kentucky. After Eberle's death, George M'Clellan issued a seventh edition in 1849. The list of localities is the same as in 1830.[32] Evidently, reports of goiter in Ohio were not frequent nor considered of great importance.

A search of some Cleveland newspapers of the period showed that they occasionally published accounts of cases presented at the clinics. (*Cleveland Daily Herald,* 29 October, 12, 16 November, 27 December 1849, 10 January 1850; *Cleveland Plain Dealer,* 24 January, 27 November, 1 December 1848, 12 November 1849.) There is nothing in any of these to suggest goiter except "encysted tumor of the neck" (C.P.D., 24 January 1848, 27 November 1848) and "thyroidal dropsy" (C.P.D., 24 January 1848).

The records of the U. S. Provost Marshal General's Bureau[33] show that the proportion of volunteers and substitutes rejected for military service because of goiter during the Civil War was actually less for Ohio (0.16 per cent) than for the country as a whole (0.20 per cent) and was only one-fourth of that for New Jersey (0.64 per cent) and only one-sixteenth of that for the tenth Congressional District of New York (Westchester, Rockland, and Putnam

* This broadside is on exhibition at the Ohio State Museum.

Counties). That there was no great popular interest in goiter in Cleveland from the 1850's through 1890 and later is indicated by its omission from the long list of disorders claimed to be cured by advertising physicians and by patent medicines.

The first mention of what may have been goiter was found in the advertisements in the *Plain Dealer* of 9, 10, and 12 February 1852, of Radway's Ready Relief No. 2, advocated for "bronchotical tumors." No such claim appeared in the advertisements of the same remedy in June 1854, June 1858, June 1860, nor from July to December 1861. However, on 3 January 1862 Ayer's Sarsaparilla, which had not previously been advocated for this disorder, presented a testimonial from Zebulon Sloan of Prospect, Texas, attesting to its merits for "Bronchocele, goiter or swelled neck." This advertisement appeared at intervals, at least until June of that year. On 23 June, under "Horse Medicine" there was an advertisement of a "Golden Ointment of Iodine," but not for goiter. A spot-check of the *Plain Dealer* at intervals from 1872 to 1912 disclosed a gradually decreasing volume of advertisements of patent medicines, with no mention of goiter in any of them. For example, on 10 January 1882, there were thirty-two of "Humphrey's Specifics" advertised, none of them for goiter.

James H. Salisbury was Professor of Physiology, Histology, and Pathological Anatomy at the newly established Charity Hospital Medical College (Cleveland) from 1864 to 1868. He died in 1905 after, apparently, having lived and practised in Cleveland for most of the intervening thirty-seven years. In 1888 he published a book which soon went into a second and a third edition.[34] In this, goiter was discussed as a disorder to be seen in Switzerland, France, Spain, Germany, Austria, England, and South America, but Ohio and the neighboring states are not mentioned. He also reproduced a long letter about goiter from Leo Lesquereux, dated at Columbus, Ohio, 9 January 1864, which dealt with goiter in Switzerland and made no mention of goiter in Ohio.

Unquestionably, there were sporadic instances of goiter. For instance, in 1871 Greenamyer[35] reported a family in Smithville in which mother and one daughter died of exophthalmic goiter. Five other daughters had ordinary goiters, the youngest having been born with one.

A few years later there seems to have been a local epidemic of exophthalmic goiter. *The New York Times* of 8 December 1880 published the following: "Ohio papers say that goitre is prevailing

in an endemic form in the southern portion of Montgomery County, that State, and causing much alarm. There are some forty (40) cases in one township, and 95 per cent of the victims are women."

In an attempt to find the original of this report, a number of Ohio newspapers of the preceding two or three weeks were examined. These included the *Cleveland Herald, Cleveland Leader, Cleveland Plain Dealer, Columbus Daily Despatch, Ohio State Journal, Dayton Journal, Dayton Daily Democrat, Cincinnati Enquirer,* and *Cincinnati Daily Gazette.* In the last, 6 December 1880 (page 3), there was found as a despatch from Dayton:

> That ugly disease, *goitre,* is prevailing in Washington Township, and in other districts in the southern portion of the County. Of some forty cases in Washington Township, 95 per cent are females. Not only are the glands of the throats of the patients wonderfully enlarged, but in many instances the eyes unnaturally protrude, and great pain is suffered. Several of the victims suffer much from pain in the region of the heart, with a sense of aggressive fullness, indicatory that there is enlargement in that region also. Some fifty persons in the region are under treatment for goitre, and the affliction is epidemic and spreading, causing much alarm.

All of the newspapers mentioned above carried a large number of advertisements of patent medicines but no mention of goiter was found in any of them. The index of the *Transactions* of the American Medical Association for 1848 to 1882 has but one reference to goiter in Ohio. This was to three cases of exophthalmic goiter reported by Roberts Bartholow[36] of the Medical College of Ohio (Cincinnati). Presumably these patients were Ohioans, though it is possible that they came from outside the state.

The files of the *Columbus Medical Journal,* which began publication in 1882, contain accounts of the treatment of goiter at such distant places as New York, Philadelphia, and Switzerland but there was none of a case in Ohio until 1901, when Whitehead published "Exophthalmic goitre, with report of a case."[37] In 1903 there was a report of a case of cretinism from Columbus,[38] and ten operations upon the thyroid were reported from Cincinnati.[39]

Examination of the *Index Medicus* from 1879 to 1888, inclusive, and of the many papers there cited, gave similar results. Apparently goiter was being reported from many neighboring states and surgeons were removing thyroids in many places but there were but few goiters in Ohio.

Even as late as 1898 and 1899, there were only two thyroidectomies a year at the Lakeside Hospital, Cleveland. In subsequent

years the largest number of goiters were reported, not from the medical, surgical, or children's services but from the neurological service.[40] Table I is instructive.

Why was there this great increase in the incidence of goiter in the early days of the present century? This question seems not to have been raised explicitly with regard to Ohio but Hayhurst,[41] apparently recognizing the general increase in the incidence of goiter in the Midwest, wrote in 1922: "Up to the last half century or so, most of the dietary salt used by goiter-free peoples has been

TABLE I

Total number of cases and number of goiters in the Neurological Service, Lakeside Hospital, Cleveland

Year	Total	Goiters		
		Simple	Exophthalmic	Cystic
1899	76	0	0	
1900	183	11	6	
1901	208	31	6	
1902	210	28	6	
1903	222	11	6	
1904	235	25		2
1905	275	33	9	1

derived from sea water, or from iodine-containing salt springs . . . and used more or less in crude form, or at least without great attention to purification, so that traces of iodine compounds have remained within it. . . ."

There is absolutely no evidence for the first part of this sentence and none to show that whatever *traces* of iodine there might have been in salt available before 1870 would today be considered adequate for the prevention of goiter. The only pertinent analysis to which Hayhurst referred was one of an Ohio brine analyzed in 1906 and said to have contained four milligrams of sodium iodide per 84.3 grams of sodium chloride.[42] This is the equivalent of 5.3 milligrams of potassium iodide per 100 grams of salt, or slightly more than one-fourth of the amount now being added to make iodized salt. In any method of crystallization, no matter how simple and crude, the removal of most of the unwelcome magnesium, calcium, strontium, and barium chlorides, which amounted to one-fifth of the total solids, would inevitably have caused the loss of most of even this small quantity of iodine.

Moreover, Hayhurst failed to mention that the publication to which he referred contained the analysis of one, and only one, other brine. This contained no demonstrable amount of iodine, although nearly four times as much sodium chloride as did the one he mentioned.

Referring to conditions in a neighboring state, Kimball[43] wrote:

> The ideal method would be the same form of goiter prevention the people of West Virginia enjoyed until 1900 or, more accurately, until the salt companies of Ohio and Michigan produced a refined table salt and promoted its sale through the state. Prior to that date there was no endemic goiter in West Virginia, but by 1922 the evidence of endemic goiter was as high as in the Lake Superior region: around 60 per cent of adolescent girls had goiter. . . . There had been no effort to prevent goiter in this section, but fortunately the only salt was a . . . coarse brown salt. In 1924 analyses showed that this unrefined salt contained iodine equivalent to 0.01 per cent potassium iodide. [This was a Malden salt.]

The cited paper contains no information regarding the analysis of the salt. It is unfortunate that these analyses and the methods employed, and how it was that a crude salt was available in 1924, were not published, for 0.01 per cent is eighteen times the highest other figure ever published and one hundred times the next highest.* It is also eighty times as much as McClendon[22] calculated as obtainable from sea water, even if all the iodine therein was concentrated into the salt.

In 1909 Grimsley[44] published an analysis of the Malden brine. He reported it to contain 0.00098 parts of sodium iodide per 60,1762 parts of sodium chloride. Even if the crystallized salt was accompanied by as much iodine as in the brine, the iodine content would be only 0.0016 per cent, one-sixth of that claimed by Kimball. Subsequent analyses of five different samples of brine from Malden[45] gave an iodine content equivalent to 4.8, 5.0, 5.5, 6.1, and 7.5 milligrams of potassium iodide per 100 grams of salt (calculated from the iodine and sodium content). Even if all the iodine were concentrated in the crystallized salt, the concentration would be only one-half to three-fourths of that claimed by Kimball and only one-third or one-fourth as much as is being added to iodized salt.

Kimball's statement regarding the coarse, brown salt in use prior to about 1900 could not be confirmed by a search of the

* In a letter to the present author, dated 17 May 1949, Parra claimed that two salts in Colombia contained 4 and 35 mg., respectively, of iodine per 100 grams of salt. However, neither these figures nor the methods by which they were obtained have ever been published.

literature. The salt made in the early years in the Kanawha valley contained red-brown flakes of ferric oxide (rust) but that was sometime before 1833. Thereafter, the salt was white and fine-grained.[46-9] Nor can one allow Kimball's claim that goiter was not present in West Virginia before about 1900. Barton[10] named a number of places in which it was present a century earlier, and Forsyth[50] reported it from Wheeling at the same period, as did Lewis[22] from the Ohio, a short distance below Marietta. In 1850 Drake[30] saw it on "the upper waters of the Kanawha." It is true that his letter was written from a point in Virginia but it is a place that drains into what is now West Virginia.

Goiter may later have diminished in incidence and may have practically disappeared as in Edmonton, Alberta,[1] Utica, New York,[51-2] Rochester, New York,[53] Pittsburgh, Pennsylvania,[54] parts of England and Scotland,[55] and many other places,[56] but there appears to be no evidence that iodine had anything to do with it. In Edmonton, after what seems to have been a complete disappearance for fifty years, it recurred and again became a serious problem.

Summary

Some aspects of the history of goiter in Ohio have been reviewed. The disease was first reported from the eastern part of the state. Even many years later it was expressly stated to be absent from Cincinnati. It occurred sporadically throughout the state but was relatively quiescent for over half a century. Goiter seems to have become a serious problem in Ohio about fifty years ago, when there was a sudden and marked increase in its incidence.

The claim that the appearance of goiter in Ohio and in West Virginia at that time was due to a change in the character of the salt has been examined and found to be contradicted by the facts.

Goiter has disappeared or has greatly diminished in incidence in place after place without benefit of iodized salt or other known sources of iodine. In some of these, it has later recurred.

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Prosthetic Therapy of Congenital and Acquired Clefts of the Palate:

An Historical Essay

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AMBROISE Paré, the famous sixteenth century French surgeon of Paris, defined prosthetic therapy "to include all methods and techniques aiming to replace tissues or organs missing from accidental or natural causes."[38] This definition, although nearly four hundred years old, still accurately describes the basic principles of modern prosthetics and specifically applies to deformities of the face and oral cavity.

Obturators are prosthetic appliances which attempt to seal a communication between the oral and nasal cavities. The resultant closure of the defect thus permits the patient to speak and take foods in a normal fashion. When a cleft goes uncorrected, the patient experiences much difficulty in eating and drinking since food tends to collect in the nasal cavity. There is also great difficulty in enunciation, and the voice presents marked nasality. Normal resonance is greatly impaired by air leaks into the nasal cavity when most consonants are articulated. The obturator restores artificially the missing portions of the hard and soft palate.

Great emphasis has been placed on oro-facial prosthesis in recent years, and the maxillary obturator has been studied with increased interest. This is due to the rapid advance of reconstructive surgery during and after the last war, the development of cleft palate clinics, and the organized attack on cancer with the aid of co-operative teamwork of well-trained specialists. Rehabilitation of patients having undergone extensive surgery for the eradication of carcinoma of the maxilla requires the construction of an obturator to restore the normal function of speech, mastication, and deglutition. Recent research on facial growth has resulted in changes pertaining to the chronological indications of surgical closure of the congenital cleft palate. Plastic surgery has postponed the optimum age for operations; therefore, mechanical appliances are required to enable the young patient to learn to speak correctly,

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and to eat and drink without foreign bodies or fluids entering the nasal cavity. Lastly, traumatic injuries take their toll, and some patients need temporary obturators to replace lost tissue till restorative surgery is indicated to close the defects with grafts.

In recent years oro-facial prosthesis has become an integral part of reconstructive surgery, and a closer understanding between surgeon and prosthodontist has resulted in teamwork with the complete rehabilitation of the patient as its aim. The prosthodontist has a definite responsibility in the treatment of acquired and congenital defects of the hard and soft palate. This unique state of affairs where surgeon and prosthodontist work together in harmony did not come about overnight but is the result of a long and bitter struggle which may be traced back in relation to the historical evolution of the obturator. This review will project the long road covered by many predecessors and enable one to appraise objectively the present status of obturator therapy.

Antiquity

Acquired and congenital defects of the palate have been described since earliest time. The Egyptians during the reign of Ramses II had specialists for the treatment of the teeth and the oral cavity.[54] Palatal defects were treated at that time with laminated sheets of gold.[7] The Edwin Smith Papyrus, which is about two thousand years old,[54] contains accounts of fractures of the facial bones and several case reports, Case 15 describing a traumatic perforation of the maxilla complicated by injury to the zygomatic arch. It is likely that some forms of obturators were used in Egypt as early as 2600 B.C.[54] Popp[41] states that the ancient Egyptians also made artificial ears, noses, and eyes. Galen in the second century B.C. described clefts of the palate. After those first efforts, historical references become scanty until the sixteenth century.

Sixteenth and Seventeenth Centuries

Amatus Lusitanus[54] is credited with having invented the obturator between 1511 and 1561. The first scientific description of congenital and acquired defects of the maxilla and their treatment was given by Paré[38] in his *Chirurgie* (1541). He specifically described defects of the palate with bone destruction caused by arquebus shots, stab wounds, or syphilitic gumma, describing also the accompanying speech deficiency and giving general principles of treatment. He used a flat, vaulted, metallic plate in gold or silver

with a sponge attached to it. The sponge was introduced into the defect, where it expanded with readily absorbed nasal and oral secretions, thus holding the obturator base in position. Paré mentioned the speech improvement resulting from the use of the appliance.

Hollerius in 1552, following Paré's work, also advocated the use of sponges fixed on a gold plate. In 1565 Alexander Petronius described palatine obturators (*De morbo Gallico*). He used wax, tow, and sponges for the bulb section of the appliance. Further progress was made by Guillemeau[21] who described a technique for the construction of obturators around the year 1600.

EIGHTEENTH AND NINETEENTH CENTURIES

Pierre Fauchard, often called "the Father of Dentistry," described five types of obturators in his classic work, *Le Chirurgien-Dentiste*.[18] He was the first to discard sponges and advocate an obturator-bulb fixed to a denture base. He also described the retention of full upper dentures by means of atmospheric pressure, adhesion, and peripheral seal, methods which have application in obturator therapy. In 1756 Lorenz Heister further perfected Fauchard's appliances. Delabarre[16] introduced the soft-hinged velum in 1820. Bourdet noticed the tendency of acquired palatal defects to close spontaneously (which might be only an observation of local recurrence of malignant disease). He designed obturators consisting of a plate of gold held by ligature wires to the abutment teeth.

Up to about 1820 obturators were primarily used for the treatment of acquired defects of the hard palate. Around 1840 surgeons and dentists began to realize the possibilities of prosthetic treatment of congenital cleft palate. Ingenious modifications of previously used prosthetic appliances were conceived to close off the oro-pharynx from the nasal cavity. Stearn (1840), Schange (1841), and Kingsley (1864),[25] and others improved the methods of Delabarre and Snell. Significant advances were made in the knowledge of the function of the muscles of palate and pharynx. The surgical pathology of the velar musculature was studied, and the physiology of speech investigated. Based on the results of research, cleft palate appliances which attempted to follow the movements of the velo-pharyngeal musculature were designed. Hulliken[17] introduced a new concept in 1850, advocating the separation of the oral from the nasal cavity by direct closure of the defect. His ideas, daring

at the middle of the nineteenth century, were followed up by Froeschel and Schalit[44] some fifty years later.

In 1869 a contribution of the greatest significance was made by Passavant who, after studying in great detail the normal physiology of speech, was able to describe accurately the function of the velo-pharyngeal muscles at rest and during speech.[39] He analyzed carefully the rôle of the posterior pharyngeal constrictor muscle, its forward and lateral contraction, and its relationship to the vertebrae and muscles of the soft palate at rest and at work. Based on his fundamental research, a better understanding of the abnormal physiology of congenital cleft palate was gained and a new basis for therapy found.

Kingsley also made an extensive study of the physiology of speech and was the first to advocate speech therapy. He based his clinical experience on a thorough knowledge of the anatomy and physiology of the velo-pharyngeal musculature in health and disease. In 1880 he published a classification of obturators and obturator speech appliances in his *Treatise on Oral Deformities*:[25] (i) Fixed-bulb obturators for the treatment of acquired defects; (ii) fixed-bulb obturator speech appliances for congenital defects of the palate, and (iii) movable velum (so-called physiological) obturators. He described in detail the construction of and indication for the movable velum fixed by a hinge or spring device to the palatal section of the appliance.

Préterre's contribution was a codification of the treatment of congenital and acquired defects of the hard and soft palate.[42] He modified the fixed obturator by adding to the hard palate section a soft rubber velum which closed off the oro-pharynx from the naso-pharynx by action of muscles on the soft velum.

Others—Reverdin, Elfert, and Claude Martin—further perfected the velum appliance. All of these speech appliances did not take into consideration the anatomical and functional relationships of the velo-pharyngeal muscles. The early obturators did not stimulate or take advantage of the contraction of the muscles by giving them support during function. They exerted pressure on the velar musculature by their spring, which resulted in atrophy of the muscles and secondary widening of the cleft. The rationale of the movable velum was to support the velar muscles. The movable appliance followed the movements of the muscles during function by means of a spring built into the bulb section. Their aim was a

good adaptation of the pharyngeal section to the velo-pharyngeal sphincter. The impressions for the construction of these appliances were taken at rest.

SCIENTIFIC BASIS FOR FUNCTIONAL PROSTHETIC THERAPY

Wilhelm Suersen[48] was the first to show the fallacy of this concept (1867). He emphasized the importance of the levator and tensor veli palatini and superior pharyngeal constrictor muscles from an anatomical and physiological point of view and he laid down the fundamental principles of functional prosthetic cleft palate therapy. The obturator bulb must close off the oro-pharynx from the naso-pharynx when the velo-pharyngeal muscles are in function and not when they are at rest. This means that the bulb and remaining velar and posterior pharyngeal muscles draw, curtain-like, during speech and deglutition, closing off the nose from the mouth. The muscles adapt themselves and brace onto the velar section of the appliance. They must be strengthened by continuous contraction onto the rigid bulb during function. Physiological stimulation is thus obtained and hyperthrophy of the muscles will result. Suersen attributed too great an importance to the superior pharyngeal constrictor muscle in the design of his speech appliances. Nevertheless, his contribution is valuable indeed, and he may be credited with establishing a scientific basis for functional prosthetic therapy.

He was in contradiction, however, with many of his contemporaries. A number of the latter followed Préterre's and Peyer's ideas (1874) and continued to perfect the movable velum appliance. Koelliker, Stoppany, Brandt, and Brugger[9] worked along that direction during the latter part of the nineteenth century. Suersen's appliance was entirely different; it was a speech aid with a rigid pharyngeal bulb, designed and constructed by a functional impression technique. His followers were many, and his daring principles were subjected to the test of time, research, and study. Billeter, Stoppany, and Warnekros[53] also followed in the footsteps of Suersen and improved his appliance, providing new evidence to confirm his theories.

About ten years later, further progress was made in the field of oro-facial prosthesis. Claude Martin[27] used for the first time on 13 April 1887 an immediate prosthetic appliance in conjunction with surgery. The poor results obtained by his predecessors in the restoration of the resected mandible (partial and hemi-resection)

CHART I
HISTORICAL DIAGRAM OF THE EVOLUTION OF OBTURATORS

MECHANICAL OBTURATORS Non-Functional				PHYSIOLOGICAL SPEECH-AIDS Functional	
For Acquired Defects		For Congenital Defects			
		Rigid Partially Movable	Movable Velum	Rigid	
Alexander		Koelliker	Delabarre 1820	Suersen	1867
Petronius	1540	1880	Stearn 1820	Billeter	1871
Paré	1580	Schiltsky	Kingsley 1864	Stoppany	1890
Guillemeau	1600	1880	Peyer 1874	Warnekros	1909
Fauchard	1728	Brugger	Martin 1880	Schmuziger	
Heister	1756	1888	Snell 1883	Durrer	1920
Delabarre	1820	Brandt	Brandt 1889	Fitz-Gibbon	
Snell	1823	1888	Olinger	Wright	to
Bourdet	1823	Pickerill	Mitchell	Olinger	
Rowell	1841	1913		Mitchell	1950
White	1851			Schuiringa	
Grath	1860			etc.	
Buckingham	1860				
Préterre	1867				
Martin	1870				
Reverdin	1890				
Gruter	1891				
Kazanjian	1914				
Martinier	1924		AIM: Musculature supports movable velum; results in pressure atrophy of muscles, defect increases in size, appliance increases in volume.	AIM: Hypertrophy of musculature; defect decreases in size, musculature gets stronger, appliance decreases in volume.	
Froeschel & Schalit	1928				
Pont	1930				
Lowery					
Mitchell					
Ackerman	1920				
Psaume					
Ponroy	to				
Olinger					
Appleman	1950				
Beder					
Schuiringa					
Gross					

prompted his work. According to Martin, immediate prosthesis consists of the replacement of the resected bone fragment by an appliance fixed in the soft tissues before closure of the wound. This idea is the first hint of the modern principles of immediate bone grafting or fixed vitallium or tantalum implants used for the restoration of bone loss in the mandible in today's plastic and reconstructive surgery. Martin aimed at the prevention of secondary cicatricial contraction and deviation. He wished to maintain nor-

mal contour and support of the remaining soft tissues of the face and prevent a total loss of function. Since this paper deals specifically with the maxilla, one might mention that Martin insisted on immediate prosthesis after partial or complete resection of the maxilla on one side. He described in detail the sequellae of maxillary resection with loss of tissue of the hard and/or soft palates resulting in depression of the cheek, scar tissue formation, cicatricial bands and adhesions, communication with the nasal fossae and pharynx, and serious functional disabilities, such as impaired mastication, deglutition, nasal irritation, and serious speech disorders.

TWENTIETH CENTURY

After the turn of the century, Froeschel and Schalit[44] introduced the meatus obturator. They based the construction of the appliance on the theory that it is not necessary to close the communication between the oral and nasal pharynx to correct the speech disorder. They closed off the naso-pharynx at the meatuses and prevented air from escaping into the nose during speech. Shalit felt that the rhinolalia aperta disappeared after insertion of the obturator. In 1913 Pickerill[17] combined surgery and prosthesis by surgical closure of the soft palate defect followed by an obturator for the hard palate cleft. Warnekros[53] further improved the Suersen speech appliance, using a thinner velo-palatal section. This was made possible by reinforcing the tail-piece with a wire. In this way the appliance did not lose any of its strength or rigidity, yet became lighter and less bulky.

Calvin Case[12] and Ottolengui[37] contributed also to the progress of cleft palate prosthesis. Case offered a technique which did not require a palatine section for retention and stabilization. His appliance was self-retaining by its anatomical and physiological relationship to the remaining velar musculature. Its lateral extensions rested on the floor of the nose. The posterior surface was muscle trimmed to the fold formed by the posterior pharyngeal constrictor muscles. Anteriorly it filled out the cleft. The appliance was light, hygienic, easy to wear, and enabled the patient to speak with normal resonance. Ottolengui emphasized as early as 1913 the importance of speech therapy and construction of a speech appliance as soon as the patient can co-operate with the dentist and speech therapist, and when sufficient teeth have erupted to retain the palatal section. He advised the construction of intermediate speech aids at the age of five.

Congenital Cleft Palate Therapy: 1930-1954

Recent technical improvements in the construction of obturators have been made by Mitchell,[30] Fitz-Gibbon,[19] Olinger,[32-6] and Wright.[55] In the past ten years, great strides have been made in the direction of the all-inclusive care of the oro-facial cripple. Harkins,[22] Tylman,[50] and Cooper[14] showed the importance of integrated rehabilitation programs. They advocated teams of well-trained specialists working together in organized cleft palate clinics. Harkins and Cooper worked out the indications for early, intermediate, and late prosthesis for the congenital cleft palate patient, Harkins stressing the surgical preparation of the denture-bearing area before attempting the construction of speech appliances.

In Europe, intensive research has also been carried out along the same lines. The Zurich school with Schmuziger,[45] Durrer,[17] and Muehlemann[31] use extensively the Suersen-Warnekros appliance when a prosthesis is required. Axhausen[6] has studied in detail the phonetic results obtained by surgical plastic closure of the cleft in relation to the age of the patient at the time of the operation. He has shown that late closure results in about 50 per cent of phonetic failures requiring secondary prosthetic treatment. He uses a prosthetic splint which is inserted immediately after the operation to protect the suture line and maintain the palatal flaps in proper position against the maxillary bone. This appliance also molds the reconstructed soft palate and results in a nearly normal vault. The French school with Veau,[51] Psaume,[43] Borel-Maisonny,[8] Cauhépé[13] and Lebourg, to mention only a few, have, like Harkins, Tylman, and Cooper, emphasized the teamwork necessary to rehabilitate the cleft palate patient. Further contributions have been made by Trauner[40] in Austria, Schuiringa[46] in the Netherlands, De Cuyper[15] in Belgium, and in England.

Recent Developments in Acquired Cleft Palate Therapy

Treatment of acquired clefts has also progressed rapidly during the past thirty years. Surgical closure of most oro-antral and/or oro-nasal clefts narrowed the indications for prosthetic appliances. Today, obturators are generally constructed only for large maxillary defects following surgery for malignant tumors.

During the first World War, Eby, Kazanjian,[24] and Stout contributed to the development of the field of oro-facial prosthesis. Contemporaries who have actively contributed to the progress of obturator therapy are numerous, including Lowery,[26] Mitchell,[30]

Olinger,[32-6] Beder,[7] Gross,[20] Appleman,[5] and Ackerman.[1] They deserve credit for their work in the rehabilitation of the maxillary cancer patient.

The historical appraisal of the development of oro-facial prosthesis reveals that until recently the surgeon and the dentist worked independently, one trying to overcome the pitfalls and deformities resulting from extensive injuries, radical tumor surgery, and congenital cleft palate defects by refined surgical techniques; the other attempting to correct long-established, acquired, or congenital deformities with ingenious mechanical devices.

Kingsley[25] condemned in 1880 the surgical approach to cleft palate therapy on the grounds that poor results were obtained by surgery; whereas many children, when fitted with well-designed speech aids, showed marked improvement in resonance and articulation. Boennecken[29] violently criticized Martin's ideas around 1890, arguing that placing bulky foreign bodies in bleeding tissues was against all concepts of surgical treatment of wounds. It has been conclusively shown in the past forty years that surgery and oro-facial prosthesis are closely related. Progress in facial reconstructive surgery and rehabilitation is dependent on both fields, and its judicious symbiosis is highly beneficial to the patient.

The interrelation of the two fields is best illustrated by the fact that the prognosis in prosthetic therapy is remarkably improved if the bearing area or bed for the prosthesis is properly prepared. Conservative surgical procedures such as excision of scar tissue, liberation of adhesions, preparation of well-planned undercut areas, and skin grafting over exposed bone, muscle, and regions where oral mucosa was lost can be used to advantage.

The same is true for the surgeon; his work is greatly facilitated if immediate prosthetic appliances are used to support soft tissues when bone loss has occurred, and when tissues have to be kept in proper position, relationship, or contour. Scar tissue formation and subsequent deforming contractures and deviation of bones can be prevented by the use of splints and stents. Many reconstructive surgical procedures of the soft tissues of the face require scaffolding appliances to support and mold tubular skin grafts and immobilize free grafts. This is particularly true when the lips, cheeks, and chin are reconstructed. The postoperative course of patients having undergone partial or radical resection of the maxilla for the treatment of malignancies of the palate and maxillary sinus is also improved when an immediate prosthetic appliance is inserted after

the completion of the operation. The obturator allows the patient to speak, eat, and drink normally, permits good surgical care of the intra-oral wound, and prevents collapse of the cheek. Gauze packs which invite infection and poor hygienic condition are eliminated, and the patient is greatly benefited by the appliance.

Conclusion

In this brief review, some of the historical facts which are the milestones in the development of prosthetic oro-facial therapy of maxillary defects have been discussed. One may conclude from the foregoing that modern concepts and principles of functional prosthetic therapy are less than one hundred years old. In 1867, Suersen laid the groundwork for the present-day obturator speech appliance for congenital cleft palate. Progress has been rapid only during the past thirty-five years and introduction of the plastic denture materials like methyl-methacrylate and the light cobalt alloys have stimulated research in recent years. But much still has to be done, for appliances are far from ideal and research in the years to come will, in all probability, modify to a great extent present concepts of oro-facial prosthesis. As Kazanjian has pointed out, progress in the field of rehabilitation is dependent upon the close co-operation of medicine and dentistry.

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Felice Fontana: The Laws of Irritability

JOHN FELIX MARCHAND*
AND
HEBBEL EDWARD HOFF**

Part II: Translation

ON THE LAWS OF IRRITABILITY
NOW FOR THE FIRST TIME ESTABLISHED
and on the inefficacy of the animal spirits
in muscular movement

By
FELICE FONTANA

Experimental Physicist to the Grand Duke of Tuscany
Public Professor in the Lyceum at Pisa,
Fellow in the Academy of Sciences at Bologna,
&c. &c.

Lucca 1767
Iohannis Riccomini, Publisher
by permission of the Praesidium

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DE IRRITABILITATIS
LEGIBVS,
NVNC
PRIMVM SANCITIS,
ET DE SPIRITVVM ANIMALIVM
IN MOVENDIS MVSCVLIS
INEFFICACIA,
FELICIS FONTANAE,
PHYSICI EXPERIMENTALIS
MAGNI ETRVRIAE DVCIS,
IN LYCEO PISANO
PHYSICES PVBLICI PROFESSORIS,
BONONIENSIS ACADEMIAE SCIENTIARVM
SOCI,
&c., &c.

LVCAE MDCCLXVII.

Typis IOHANNIS RICCOMINI.
Praesidum Permissu.

Fig. 1. Title page of Abbé Felice Fontana's original Latin edition: *De legibus irritabilitatis,* published by Iohannis Riccomini at Lucca in 1767. The volume from which this plate and the translation were made is in the Yale Historical Medical Library.

To the illustrious, magnificent
Johannius Georgius De Lagusio
Councillor to the Court
and
Physician in Chief to the Grand Duke of Tuscany

Felice Fontana
dedicates this offering

Hallerian irritability from its beginning caused many disagreements among dissenting investigators of Nature throughout Europe, and in Italy particularly such feeling and emotion that it sometimes appears to be, as not inelegantly phrased by Nonnemines, *an irritation to all Italy*. To a man of your parts and achievement all this is not unfamiliar. Nor are you unaware, too, of how bitterly Irritability was opposed at the beginning, and with what heat it was disputed (as is usual always with the introduction of anything new), how it won over at last the votes of most Philosophers, and how afterwards, as the tumult subsided and spirits calmed, the whole matter seems to have been returned to a unified, and so to speak more balanced point of departure for Philosophy and for experiment; Irritability now seems to reign in universal Philosophy much as Attraction does in Celestial Physics. However, no one up to now has undertaken to work out its properties, laws, and modes of action; even its Discoverer, the great Haller himself, was content to locate this force within the living body, to establish its paramount role in Physiology, and to go no further. My illustrious predecessor has thus imposed on me the task of establishing analytically and through experiment the Laws of Irritability, to define these laws, and to circumscribe the boundaries as it were, beyond which this potent force does not transgress.

I have noted that not a few important names and authorities openly deny this property of muscle fiber, although in such skepticism they overlook Haller's experiments. Among the *Hallerians* as well no one up to now has shown that animal Spirits could not be the effecting cause of muscular movement. The reward of my effort on this problem has been to read the animal Spirits out of office, forever, by sound logic and new reasoning in the absence of which nothing novel or above dispute would yet have been stated by the *Hallerians*.

On this my first Offering your valuation stands above all; only when it has won your approbation can I deem my effort worthy of

the Learned. Who indeed could fail to strive valiantly for approval by one whose achievement has been acclaimed by Leaders in so many fields, and whose place in Letters is so firmly established by that noble child of your genius in medicine[a] with which no one is unfamiliar. Judge, then, on my little Work such as it is, inscribed

EX hoc igitur fonte promanarunt illae omnes, quae dicuntur Naturae leges: in quibus multa ſane ſapientiſſimi Conſilii, nulla neceſſitatis, apparent veſtigia. Has proinde non ab inventis conjecturis petere, ſed obſervando, atque experiendo; addiſcere debemus.

Rog. Got. in Praef. Princ. Phil. Nat. Newt.

Fig. 2. *The origin of all laws of Nature is such that to the wisest judgement no vestiges of necessity are apparent. These we must seek not by invention and conjecture but by observation and experiment.* Fontana admired Isaac Newton's classic treatise on celestial mechanics, and quotes here from Newton's *Principles of Natural Philosophy.*

with your name, by the wise and fitting counsel with which it has been your custom to favor my labors; knowing that to me, as an admirer of your work, no other consideration can outweigh your valuation on it.

Florentiae III. Idus Novembris MDCCLXV

The Laws of Irritability

Part I: Law I

On the action of Irritability which for single contractions of the fiber must always be excited by a new stimulus

I. Arduous and difficult is the road on which I am about to set forth, in venturing to discuss the question of that new property of animal fiber named *Hallerian Irritability* after Haller, its famous and immortal discoverer. I shall investigate, then, the principal

[a] Historia Medic. morb. Epidemic. Historiae Medic. Trium morborum.

laws of this new property, establish its limits, examine its essential nature and character, and undertake to unfold and reveal before men the complexities and obscurities of the motion of animal fiber; all briefly and concisely, not to be too irksome with wordiness.

II

DE IRRITABILITATIS LEGIBVS

PARS I.

LEX PRIMA.

De Irritabilitatis actione, singulis Fibrae contractionibus novo ſemper ſtimulo excitanda.

I. ARduam, et ſalebroſam, ingredior Quaestionem de nova illa Fibrae animalis facultate diſputaturus, quam ab inventore *Hallero*, Viro magno

Fig. 3. First page of the original Latin edition of *De legibus irritabilitatis.*

II. At once, in the definition of the problem itself, it must be asked whether irritability is a property of the muscle fiber, and whether all successive and recurring contractions of an irritated muscle must be referred to this irritability which they have taken on, or to a primal cause, and whether they be by their own right all like the first contraction, or whether rather for single contractions an exciting cause is required upon cessation of which the relaxing

muscle itself in the same moment becomes quiet and contractions are extinguished.

III. Believing firmly in the quality of elasticity in bodies, it used to seem to me that I saw a certain similarity and analogy between elasticity and irritability, so that I shall now consider whether all successive muscular contractions should be attributed to this irritability, rather than that the continuation of tremors and vibrations be attributed on the other hand to elasticity. In truth, if elasticity alone can (thus silently I was debating with myself) preserve for a long time in bodies oscillations which are once taken up, then why will irritability alone not have been able to conserve contractions once aroused in the muscle?

IV. On this matter I on more than one occasion consulted with various men who are learned and highly versed in investigation of the animal mechanism, in order to confirm or set aside my opinion by the authority of these distinguished men. And on this particular point those whose opinions I asked were all agreed: continuation of the contractions of a muscle must be referred to the initial stimulus once brought to the muscle, and irritability once aroused is capable of producing successively these contractions.

V. Confirmed in this opinion by the authority of very learned men, I remained satisfied for a long time. It chanced that no difficulties immediately came up to compel me to remain undecided until, with the following discovery, light, so to speak, dawned upon me which dispelled all shadows and revealed, I truly believe, the actual and real cause of the phenomenon. I discovered, or it seemed to me that I discovered, that the succession and continuation of the contractions of muscles are by no means to be attributed to a stimulus applied only once (the belief which I, under the protection of eminent men, if you wish, had myself held), but rather there must be a new stimulating cause for each new contraction, one which acting successively elicits successive rhythms in the muscle. This opinion, which I have scrutinized for a long time, and have submitted to the judgment of clever men in order that nothing might lie hidden which could catch me unawares, I shall take pains to prove only with the soundest arguments and to place beyond the range of every weapon with every difficulty squarely met, and thus I embark on the line of reasoning.

VI. Everyone agrees that when the effect of a cause ceases, action ceases: thus the irritable force of the fiber of an excited muscle is

influenced by the very contraction itself of the muscle in such a way that it must cease at the time the muscle relaxes and becomes restored to the original state; the action of irritability will cease, therefore, at the same moment: the muscle then contracts again; therefore the action of irritability, which had perished in the contraction of the muscle, will again be excited; therefore there will have been a new stimulus to bring forth the new action of irritability. And so, indeed, for new contractions there will always be need for a new stimulus to call up again sleeping and lifeless irritability.

VII. Furthermore in cattle and in dogs and calves and various other creatures I have found that hardly is the blood drained from them when the heart grows quiet and ceases to contract; thereafter with the application of extraneous stimuli it still responds with one contraction to each stimulus, although never do two contractions result from a single stimulus, a fact which would not be the case if the continuation of the contractions were referable to an irritability once aroused and acting as a cause of itself, as it were, in the same manner as the continuation of tremors in elastic bodies results from the continuous action of elasticity.

VIII. The force by which muscle is contracted becomes extinguished again because of the resistance of the contracting fibers of the muscle; otherwise muscle would always be more and more contracted and would never return to the original state. Extinguished force of irritability must therefore be called forth anew in order that muscle which has relaxed will contract again, and furthermore it will always be necessary for a new stimulus to be present for subsequent contractions to be released.

IX. I observe, finally, that muscle contracts by the force of irritability and relaxes by an elasticity whose direction is opposite and contrary to that of the former; the former is exhausted by the latter, or perhaps ceases from free action by some property of its own, on contraction of the muscle, which demonstrates most clearly that irritability quiescent in muscle can by no means be excited immediately after relaxation and by a new stimulus, unless we elect to go insane for some reason, and consider irritability as acting throughout the interim by its own nature and with no assistance from a new exciting cause, in which case all the clearest laws of physics are flouted.

X. Most, and in fact all animals, when the thorax is opened, either if they have lost a large amount of blood or have expired shortly before, demonstrate that the heart, growing quiet after a single diastole, does not thereafter contract, no matter how much its ventricles continue to receive stimuli from the venous blood. This in fact is very well seen in various creatures such as the eel, tunny fish and turtle, where the heart remains in a state of relaxation for many minutes of the hour long after the ventricles have been filled by blood. Irritability is therefore silent during that time, since it brings about no change in the loose fiber of the relaxing muscle. Consequently to obtain a new contraction of a muscle there must be a new irritation and a new external cause producing stimuli to the fiber which will excite it.

XI. Our opinion is confirmed by the following point that I have taken up which everyone holds to be established concerning the forces of bodies and their mode of action, and which will be clear to every adversary. For we can observe and understand that bodies once set in motion neither deviate from the path of the direction imposed nor come to a stop and return from it in the least unless that force by which they are first moved is either extinguished or altered. Accordingly bodies which are thrown perpendicularly do not return by their previous path and submit to gravitation before the throwing force has utterly perished; and in a not dissimilar way pendulums and elastic oscillations change their direction. This phenomenon or property of bodies is one designated by the physicists as the *force of inertia* and holds first place among the three fundamental principles of the whole science of mechanics. And therefrom it is clear that when a muscle is irritated and drawn into contraction by the action of a stimulus, it cannot relax before the contracting force which the stimulus has excited is utterly extinguished. But the muscle is relaxed by a new force; therefore it is necessary that a new contraction must again follow diastole.

XII. And now, in order that absolutely every occasion for contradiction may be removed and no room left for doubt, I shall come directly to the point and furnish an insuperable argument to prove most clearly that successive contractions of a muscle must be attributed to new successively acting stimuli. In whatever manner muscular contraction is explained by physiologists, it is quite clear and well known that for releasing muscular contractions there is required either a swifter movement of the animal spirits, or a more abundant flow through the nerves, or both together, in a

word, there must be a greater impetus of spirits rushing into the fiber and force sent to it; and when in a short time this impulse languishes and utterly ceases and the animal spirts have regained their original state, then contraction of the muscle finds a limit and there is restoration of the original state of affairs. Such being the case, we daily observe how almost in single moments innumerable movements are carried out by animals, now one, now another part of the body is agitated and shaken, muscles previously contracted relax, and remain relaxed and the movement of the limb ceases by the will and command of the animal, and many other examples of this sort. And indeed if the alternate succession of muscular contractions really depended on the nature and quality of the fiber, it is quite clear that these effects in animals could never come about, and most miserable would be the condition of all living things, forsooth, when, with head once lowered, they would forever raise and lower it, fingers once closed would never cease to close and open, eyes once raised would forever raise and lower, the body once set in motion would never come to a standstill, nor would they even withdraw from impending destruction; if a single of these examples does not overturn and crush opposed opinion, then which in nature be true and which false I know not.

XIII. I come now to the example of elasticity which originally impelled me to refer successive movements of muscle to an irritability excited once.

It is obvious that a steel band once struck vibrates for a long time and a pendulum long oscillates by gravity alone, and this most clearly confirms my opinion, however much there is lacking that could weaken it: as soon as a compressed band has been restored to its original state it encounters multiple impetuses and impulses from the elasticity acting upon it, by the preservation of which, because of the *force of inertia* in the band, it is flexed in the opposite direction in compliance with the pushes acting on it, but again it is restored anew by the supervening action of the elasticity which always asserts itself in the curved band; and again in this second restitution, with continuous impulses received from elasticity, it is bent for a third time, and thus moreover it is moved back and forth until the resistance of the medium has prevailed and because of the imperfect nature of the elasticity itself the going and coming vanishes and becomes completely extinguished. The pendulum, similarly, when it reaches the extreme limit of its vibration, perpetually receives new impulses from gravity with the help of

which it ascends the opposite side, from which again it slips down by force of gravity, and again having received an impulse is elevated and so indeed it continues to be moved until from external causes the movements are destroyed. Now no one fails to see either that the band is deflected in the opposite direction by force of elasticity, or that the pendulum, by ascending the other arc, illustrates the force of gravity; for nothing else is possible, however violent elasticity, except that it should restore the previous state of the bent band; and gravity surely cannot elevate the pendulum above the lowest point of the oscillation, unless it acts in opposite directions, now upward and now downward, which is opposed to the simplest concepts of physics. In animal fiber, however, we observe nothing of the sort. Touched with some stimulus the fiber contracts as if it passed from a natural state to violence; presently it becomes relaxed, returns to its original state, and takes on the original softness and flexibility and whatever it may be which was present before contraction. But nothing is known in the muscle of such a nature that it can cause alternating contractions and conserve movement, as we find is the case in the elastic blade and the pendulum. Furthermore contracted muscle, when it relaxes, never extends beyond its usual length, a fact which I myself have repeatedly observed with great care; herewith falls to the ground, then, the conjecture of those who deduce alternate contractions of muscle from an actual greater length of fiber which they think muscle acquires on first relaxing, so that it would therefore continue to vibrate until its natural length were reached.

The hypothesis then falls to the ground when this foundation is removed, on which it mainly arose; but it cannot even stand if we concede to them that muscle, when it is relaxed, is stretched beyond its natural length in the manner one may observe in elastic bodies and oscillations. For what from this they can infer toward avoiding the necessity for a new stimulus in order that new contractions in the muscle may take place I do not see. In cold-blooded animals which have suffered sufficient loss of blood, the relaxed heart often remains quiet through many minutes of the hour. In those which rejoice in a finer body and are finally growing old, a single systole of the heart responds in every case to a single stimulus, and when all the ventricles are entirely empty all motion in the heart completely ceases. Since, therefore, between relaxation of the muscle and restored contraction a notable rest intervenes, and since when every cause of sensible stimulus ceases no new contraction occurs, it is shown most clearly to the very sky that oscillation

resulting from overstretching of muscle is not distinct in cause from what is termed irritability. For when the elastic body, after repeated smaller and smaller oscillations, has become quiet, what force of elasticity is present which of itself begins the game anew? But this hypothesis, as if it were not already contrary to our opinion, I can also refute with additional reasons and show to be completely fictitious. In those animals in which the heart moves slowly quite conspicuous would be the transition of a heart from the state of contraction through natural processes into one of relaxation which was, so to speak, too violent; quiescence again after this we would then not see; for unless restitution to its natural state should first appear, the muscle would have to be said to quiesce into some sort of violent state. But we ourselves, on the contrary, do not feel that muscles subservient to our will, after voluntary relaxation, spontaneously contract themselves a little to seek their natural state. A fable, therefore, or a chimaera they thrust at us, those who dream of such a manner of relaxation, and nothing of the sort exists to cause a muscle to contract.

XIV. Discussion with others raised difficulties which I am not willing to dissimulate, but at the same time I shall ward off their force and impetus. In cold-blooded animals if the heart torn from the thorax is once irritated by some stimulus, it recovers the lost movements and keeps and preserves its vibrations through several minutes: frogs' hearts, enclosed and covered in a glass vessel, if they are isolated from the outside air, recover motion and by alternating forces are contracted and dilated. Therefore if the stimulus is once applied the fiber either becomes contracted and long continues to be moved without outside aid, or else it does so with the help of some new stimulating cause.

The proposed difficulty falls to the ground if we observe that there is no necessity (where some peculiar event has occurred) for examining singly the causes of a persevering contraction in muscle which can lie hidden and elude the acuity of one's eye and ingenuity, after we have demonstrated conclusively and *a priori,* as it were, that muscle once relaxed cannot contract unless some new cause calls back the sleeping irritability, and that the single contractions of the muscle arise from single external stimuli. For unless I am in error there seem to me to be innumerable efficacious causes which acting successively on a fiber would maintain and conserve its motion for a long time. Air, for example, a most subtle and mobile element accountable for innumerable changes because of

elasticity now augmented now diminished, never growing quiet never remaining the same, air-born particles rolling about in it in various paths, the never constant heat of a fire, various humors now more swiftly now more slowly flowing to this and that muscle, movement of the intestines, fermentations, gas evolving from the humors themselves and expanding the fiber, all these singly or together can arouse irritability lying idle in the fiber and call forth again in muscle the extinguished movements.

XV. What has been said in this connection points the way toward solution of a difficulty which I remember once came up concerning the new system of irritability, and which I long considered invincible and insoluble. Even if an external stimulus never be removed from a fiber, but always touch and irritate it, yet not for as much as a single instant does contraction of the fiber persist, although it ought to last as long as the stimulus acts in exciting irritability; this action of stimulation being perpetual and continuous, also perpetual and continuous should be the contraction of the muscle. Nor do those seem to solve the difficulty who, granting the stimulus permanent, are of the opinion that muscle can be restored by the fact that however great the *exciting* stimulus it would not be the actual effective cause of muscular contraction, and that the nature of all exciting causes be this, forsooth, that no effect whatsoever follows them. By this response the difficulty is not solved: for if indeed the spirit of the animal spirits through its power holds muscles contracted over a long period of time, as is obvious to anyone, the activity and influx of the animal spirits will have to be said to be very great and most forceful indeed, predominating actually over a fiber attempting to restore itself by elasticity, and also not lesser than the force of irritability, yea greater even, because of the constancy of the action. If therefore the animal spirits have the strength to hold muscles contracted, they will also have it to contract them; they will be thus the effective cause of muscular contraction, and the principle of irritability will be either useless or quite precarious.

Anyone who will have considered seriously the gravity of this difficulty will not fail to perceive how hard it is to find a fitting response. But, unless I am very much mistaken, from principles previously established and from accurate observations of actual muscular movements the proposed difficulty is refuted, and more light can indeed be poured on it from this dissertation. I have already demonstrated previously and could confirm with new proofs and experiments that for single contractions of muscle a

new stimulus must be applied to call forth irritability successively: should there be continuation of a stimulus, then from the essential nature of irritability and the condition of the muscle itself it follows that the muscle must become restored to the original state, as I shall explain more fully below. So from this point the difficulty gives way, regardless of what the reason may be that muscle once contracted by command of the will can remain so long in that state. And in this case I definitely suspect that a fiber contracted in one instant is restored again in another with such small swift and momentary restitutions that we cannot identify them. When an irritated muscle is excited by the force of irritability, the latter is suddenly extinguished with the contraction of the muscle; but hardly has it perished when, because of the elasticity of the contracting fibers, the muscle strives to restore itself, and in the same moment in which it passes into relaxation it acquires the condition necessary for recovering the action of irritability, therefore it contracts anew, although action of the stimulus persists throughout; and since this process involves only very swiftly passing moments of time the muscle will always appear contracted, because of its very small and rapid relaxations, which pass as they arise, escape the keenness of the eye. A simple and familiar observation illustrates this view. I have noticed that muscle cannot remain contracted without the appearance of a certain continuous tremor arising from very small and swift relaxations of the muscle. I confess, however, that when external stimuli are applied to a fiber continuous contractions cannot be obtained; but certainly in causative effect their force and potency are weak, acting on only a few external fibers. Internal stimulation, on the other hand, and the very potent nervous fluid, penetrates throughout all the meatuses and anfractuosities and all the smallest parts wherever they be, and arouses native irritability. Electric vapor, which in mobility, force, and subtlety, and some sort of more persistent power of penetration emulates the animal spirits, holds the muscles of frogs contracted for some time. With what has been said up to here it is abundantly shown that animal fiber vibrates continuously and rapidly, if contraction lasts for any length of time: indeed in each instant it strives to restore itself and in each instant the action of irritability perishes and revives again.

XVI. In warm-blooded animals and grown calves in particular the heart once irritated contracts just once, as I have found many times; this quite clearly shows, unless I am in error, that for single

contractions of its muscle a new stimulus must always be present. I have noticed also that a stimulating cause acting with moderate strength is applied in vain and that no contraction follows from it; thus the air stirred gently is incapable of recalling irritability. When the blood is drawn from either ventricle of the heart of larger animals, the movement immediately ceases, a fact which, since the year 1757, I have tested on many occasions with my illustrious friend Caldani, the same, in fact, as the observations of the immortal Haller and Whytt, whom no one need suspect of being deprived of their share in the study. Concerning the motion of blood Haller likewise noted, in an excellent piece of work published in the Commentaries of the Academy at Göttingen, that the right ventricle of the heart and the auricle at once grew quiet after exhaustion of the blood, while motion nevertheless persisted in the other ventricle, from which blood had not been drawn. These experiments I have myself repeated with many distinguished professors at Bologna, and repeated with the energetic Caldani, always with the same outcome. When Pujatus, the very illustrious professor in the Academy at Padua whose recent death is mourned by the world of letters, asked me to empty of blood the left in place of the right ventricle, and this at once was done, he was surprised that the left ventricle and auricle suddenly became quiet, while the other ventricle and auricle moved as before. All of which clearly proves that when the stimulus is removed contraction of the fiber is taken away, and that alternate rhythms of the muscles take origin from successive application of a stimulus.

Law II

On a force of Irritability which must again be aroused after a definite interval of time, depending on the varying nature and condition of the fiber

I. To the establishment of another law of irritability we now hasten; and we arrive at the necessity for demonstrating the nature and character of irritability as such that it cannot be manifested except after a certain time and under some certain condition and state of the fiber. We evolve this by the analytical method.

II. The brilliant Whytt observed long ago that, after the animal heart has lain motionless for a long time and apart from the action of any sensible external stimulus, it becomes moved spontaneously and the original contractions alternate for a period, then grow

quiet, and again are moved; and this occurs over a long interval of time. These same tests I myself have many times undertaken with the hearts of eels, frogs, turtles, rabbits, goats, and other smaller animals, almost always with success.

III. I also wished to discover whether after the first or some other quiet phase of the heart external stimuli, a breath of air, a very light puncture, or a sudden contact would recall irritability, and I found that motion absolutely never appears, but on the other hand I observed that when the stimulus was removed this motion after some time revived spontaneously. This I have also observed in the hearts of turtles and frogs, but particularly in eels, of which the heart still attached in the thorax and gently beating would never accelerate no matter how violently I irritated it, for example, with blowing, pouring water on it, or tickling it with a fine feather.

IV. In some animals the heart beats most swiftly, in others more slowly, and in still others very slowly; thus I have observed that the heart of the frog beats sixty-seven times a minute, that of the eel twenty-four, that of the turtle hardly ten. The number of these pulsations is indeed the more diminished in proportion as the animals of this sort lose more life and blood, since I have witnessed on other occasions that the heart beats, in a minute of time, ten times in the frog, and two or three in two minutes in eels, and in the space of twenty-two minutes ten times in the turtle.

V. In warm-blooded animals more nearly approaching the state at the time of birth the motion of the heart is far more excited and swift, for instance in the common squirrel *Scojatolus* the heart beats five hundred times or more in the period of a minute, which could seem incredible if multiple observations had not convinced me.[a]

VI. The auricles of the heart of animals, whether they are cold or warm-blooded, vibrate two or three times with single contractions of the ventricles; and whether the animal be alive or dead,

[a] It will seem quite incredible to many that such a tremendous number of pulsations could be counted with sufficient accuracy, since by sense we can hardly measure more closely than one-fourth of the time of a second. But I have instituted a method. The phrase *onetwothree*• I would pronounce rapidly; and one beat of my pulse beating at the same time just filled three pronunciations of this word. When the hand was applied to the squirrel's left side, hardly was the word well spoken and the first syllable of repetition not yet well uttered when the heart of the tiny animal was impelling it already with the fourth impulse. This experiment, continued over a long time, never affected me with a different sensation. Accordingly for three completed oscillations of my pulse the heart of the little animal produced at least ten rhythms.•• And the pulsations of my brachial artery equal seventy-five per minute of the hour; therefore that tiny heart renews its oscillations at

whether the heart be torn from the thorax or remain attached in it, this is very frequently observed.

VII. If we now wish to clarify and attack with a keener mind the observations and experiments recounted up to this point we shall come upon much which will lead us by the hand, as it were, toward establishing another law of irritability. In the first place certain experiments of Whytt (II) undertaken on hearts of frogs and also tried by me many times on other animals, ones in which the heart after a certain period of time recovered lost motion regardless of whether the air was growing quiet or keeping to its original condition, seem to cast some suspicion that the fibers of the relaxed heart which do not yet desire the action of irritability have not, up to this point, attained the status, condition, and situation under which irritability is accustomed to be manifested and which compel it to become aroused and go into action. But when a certain space of time has elapsed sufficient for the muscles to attain that state of the fiber under which irritability develops, which we shall term here the *state of irritability*, the heart again begins to be moved, being irritated by the external stimulus of excessive motion of the air or by internal stimulus.

In fact these experiments, as I may say in passing, furnish a truly valid argument whereby we prove most conclusively that new action of the stimulus is necessary for all single contractions of a muscle. For certainly no one will ever persuade himself that the force of irritability so long dormant and dead in an animal fiber can actually of its own self and without an external force or stimulus or the help of an impulse suddenly revive, become excited, act on the fiber, overcome its elasticity, and suddenly contract the muscle. Forces of this sort do not occur in nature, and can not exist, being opposed to the most obvious concepts of metaphysics. Therefore in this and similar experiments there must be present some external stimulus, or an internal one lying hidden in the muscle, which by constantly irritating it prepares the muscle for

least seven hundred and fifty times per minute of the hour. A third part of these I have subtracted in speaking of the natural state of order not to seem to attribute too much to the trepidation of the animal, a species by nature fearful, but made a tame pet by virtue of daily familiarity.

* [*Undutre. Tr.*]

** [*Quare tribus pulsus mei oscillationibus exactis decem saltem Rythmos Cor Animalculi edit.* The three pulsations of Fontana's brachial artery corresponded to nine pronunciations of his phrase *undutre*, and therefore, (since there were four squirrel's beats per word) this was equivalent to thirty-six squirrel's beats for three beats of Fontana's pulse, a ratio of something over ten to one, or an incredible 750 as compared to the 75 per minute of Fontana's own pulse. *Tr.*]

contraction at that time alone when it has arrived at the state of irritability.

VIII. Experiments previously related (III) seem to press the point now more convincingly. The heart, once relaxed in diastole, even though irritated by an external stimulus, would not contract, but remained unmoved. At that time therefore the fibers of the heart were incapable of being desirous of irritability, therefore something was lacking in the state and constitution of the fiber itself which impeded the manifestation of irritability, and consequently some certain interval of time is required for the extinguished action of irritability to revive again. When some time had elapsed, however, the heart again contracted from the slightest movement of the air or contact of a feather and the exercise of irritability recurred.

IX. In certain animals the various heart beats which we have discussed (IV) make evident the return of irritability after different intervals of time in different animals. Scarcely is diastole of the heart completed when blood is present in the ventricles and fills them and incites the fibers by irritation; yet the heart does not at once contract or undergo systole, nor is the time consumed in diastole the same in various animals, but in some is longer, in others shorter, which leads to the various frequencies of the slower and faster beats. In the intimate structure of the fiber causes lie hidden because of which it acquires the state of irritability more swiftly or more slowly.

X. The nearer animals are to the embryonal state, the more vigorous and prompt the force of irritability; the heart and all the muscles contract at the slightest touch, which serves as an argument that irritability in them revives as soon as blood or some other stimulus makes contact with the fiber and does so the more promptly in proportion as the animal more closely emulated the state of the embryo. Hence the marvelous frequency of pulsations in squirrels will rest on the same principle; for actually the fibers of these tiny animals almost in the moment of contraction itself again recover irritability.

From these experiments themselves strength accrues to our theory in which we seek to show that in every state of the muscle there is need for a new stimulating cause in order that the action of irritability consumed in the contraction of this muscle and utterly extinguished may revive and be restored. A heart, quiescent

through many minutes of the hour and separated by a glass covering from all contact with the outside air, is suddenly moved. Not lacking, therefore, was a cause acting on it, in fact some new stimulus exciting the irritability in the muscle; for never do bodies change their state of rest or motion in the absence of a cause acting on them. And if the heart held itself relaxed for eight or ten minutes it could not have been without that cause in order to recover movement; why therefore is such a cause not needed where it will have arisen over a more brief space of time, as in turtles, in which the heart is not contracted until after two minutes have first passed? Or a single half minute, as in eels? Or even six seconds, as in frogs? This train of reasoning gradually leads us to the heart of man, and that of the squirrel. For the duration of the quiet phase in it does not alter the nature of a muscle.

XI. Experiments already recounted (VI) clearly prove that the heart needs some interval of time in order to be able to recover the function of irritability which it has lost in diastole. The auricles continue to be moved and propel blood into the ventricles, the stimulus continues to act on the walls by irritating them, yet the heart does not contract on this account; it does contract, however, after many beats of the auricles. Whence this, unless from a state of the fiber such that after it expired it would render a previously ineffective stimulus effective? The auricles themselves vibrate with greater or lesser swiftness, and the number and frequency of vibrations diminish with the passage of time, that is, relaxation does not suddenly bring the beat to an end, and they become contracted even if the venous blood of the cavae always wets them. Not always, then, does inactivity come about through the absence of a stimulus to the heart and auricles. The heart also continues to be moved when the blood is exhausted from the auricles. Consequently the muscular fibers require a certain determined time in order to exercise the force of irritability.

XII, The rapidity of the heart in most animals seems to depend most heavily on the greater or lesser disposition of the fiber and on its aptitude for sensing the action of external stimuli as well as for exercising its native irritability. In fact in some animals the heart moves more slowly and in others more quickly even if in each case the heart be irritated by the same stimulus at the same time. In the same animal the auricles which previously vibrated once with single vibrations of the heart at another time oscillate two, three, four, or several times while the heart beats once: clearly the fibers

of the heart which previously reverted to the *state of irritability* more promptly now return to it more slowly. Thus the heart of squirrels, for example, will be so arranged and so constructed that hardly is it relaxed when it will already have captured the force of irritability and each of its fibers will have attained its original disposition and state. But this disposition of animal fiber toward more swiftly or more slowly sensing the stimulus may depend on the various distances of the filaments making up the fiber, on their various shapes, on various movements and directions of the flowing humors, on divers contacts of the primary threads, various properties which the fiber recovered at one time more slowly and at another more swiftly, also texture of the muscle, flexibility, softness, &c.

XIII. You would not suppose, moreover, that a muscle, whether contracted or relaxed and much less immediately after relaxation, would suddenly lack all of its irritability. I have sought to demonstrate this, and also the fact that the irritability was not of such a high degree but that contraction of the muscle was consequent to the force of a previously given stimulus; however with increase in the force that excites it you would not poison irritability so that contraction of the muscle could not be obtained. Indeed I have found on the other hand that a muscle irritated with a fine needle showed no sign of movement but could on exposure to electric vapor be sustained continuously in contraction. In this case greater effect is not necessarily obtained even from the animal spirits, at which we wonder, for certainly that fluid is the most active of all, and most apt at producing irritation.

XIV. Some will ask why contracted muscle is suddenly restored, to whom we reply thus: when the force of irritability is consumed in contracting a muscle, and extinguished by its action, there remains in the muscular fibers an elastic force which, acting of its own right, restores the fiber to the original state of relaxation. Since muscles which are restoring themselves do not at once recover that disposition by which, when they are irritated, they can contract again, and do not all suddenly acquire the state of irritability, therefore not always nor in every case does a muscle go on to a second contraction, even if it be continuously roused by a stimulus; therefore the heart of frogs, dogs, cats, and young goats contracts not after a partial but only after a complete relaxation: for the half-relaxed heart in these animals has not yet developed that disposition under which irritability is accustomed to be manifested.

But if a stimulus be applied before the necessary time for full and perfect relaxation of the muscle, the muscle contracts imperfectly, since it has not yet completely recovered the state of irritability; if however you await the required time, even the lightest stimulus most effectively contracts the muscle.

XV. If action of irritability does not always recur at the same time, and affects the muscle sometimes more slowly, at other times more quickly, will it not also become extinguished at different times? I have observed in many animals that muscles which have already been cut and placed on the table do not at once relax after contraction; the heart attached in the thorax of an animal, whether living or dead, is not at once restored after systole, and indeed from the final state of contraction to the first instant of dilation some physical event must be recognized as escaping the eyes. In some animals, especially hot-blooded ones such as birds it seems contradictory, and no interval is discovered between the final moment of contraction and the first of dilation, instead the end of the former and beginning of the latter fall, as we perceive it, in the same instant. This occurs in squirrels. But is not then the action of irritability extinguished in some animals more swiftly and in others more slowly? And does not the rapidity of systole of the heart depend on this longer or shorter duration of the irritability which has been excited? And does there not arise from greater rapidity of the systoles the swift pulse which is distinguished only by this frequency? Indeed this swiftness of pulse, since it takes origin from an even more active irritability, will have therefore a mode of action derived from that of this more active irritability, and from the action of that original facility with which the fiber, when contracted, loses irritability: consequently the frequency of the pulse, other things being equal, will in mode of action depend directly on the rapidity of the pulse and inversely on the time which is consumed in exciting irritability after relaxation of the heart.

Part II

On inefficacy in the animal spirits in muscular movement

I. The nature of irritability having been examined, it is proper for us to evaluate now the power and force of the animal spirits in effecting muscular contractions; that animal spirits are only an *exciting* and in no wise actually an *effecting* cause of muscular movements will be seen to follow from what has already been said, and

only for clarification do we take it up. With these arguments we shall therefore come forward in order that we may state confidently that the matter stands in no uncertain light, and in order that the commonly accepted belief concerning the *effecting* cause of muscular movements, if not utterly demolished, may at least be weakened.

In response to those who, contrary to the celebrated Haller, cling to this belief, I reduce the sum of the arguments to three headings. Firstly I shall set forth that muscle once contracted cannot become relaxed according to the hypothesis of our adversaries, which is contrary to all experiments. Secondly that when it has undergone any relaxation it would immediately and forever contract. Thirdly that it would have to contract of necessity even at the very moment when it has quieted into a state of relaxation.

II. Contraction of the heart would go on forever if in the animal spirit, which we would consider the supposed effecting cause of contraction, movement should continue to act through the same cause which was already sufficient or more than sufficient for contracting the heart. This depends entirely on the nature of the effecting cause. But the heart, as is clear from all experiments, relaxes while the ventricles are still filled with blood; this experiment I also, after the brilliant Haller, have performed on auricles from which the vessels carrying blood away were ligated. Since the action of blood on the nerves does not cease in the course of time, why does not the animal spirit conserve its motion and sustain contraction? In addition to the weight of the blood by which the nerves were compressed in the first place there is also the force and pressure of the cavities of the heart on the blood itself. These things notwithstanding, not only with increased cause does the effect not increase, but truly it even utterly ceases. The animal spirit, therefore, is not an effecting cause of contractions. A heart muscle pierced by a great needle, deeply transfixed, torn apart, with action continually applied to it, does not maintain contraction; and nothing further do you gain with more drastic stimuli; in spite of it the heart and all the other muscles also, as soon as they have attained the state of contraction, become restored to the original one of relaxation. How then does it come about that even the slightest titillation of a single fiber excites such a commotion in the animal spirit that the muscle contracts; yet the heaviest and most universal action continually applied to the same animal spirit does not maintain the contraction? In conclusion, then, and as our adversaries may reply, the nerves are driven to greater action and the animal

spirit is more aroused by one drop of water applied to the fibers of the heart, or by a light feather which by its motility touches the muscle so lightly, than by a bigger needle or by the venous blood of the ventricles of the heart, whereby the fibers are either torn apart or by a universal and widespread impulse rudely disturbed.

III. However much they construe the animal spirits as the effecting cause of organic movements, all with one voice contend that nothing else is required for animal fiber to become contracted but that even the lightest impulse be impressed on the animal spirits, whether *immediate*, as comes about from the mind when some part of the body is moved by the will of the animal, or *mediate*, when undoubtedly external stimuli are applied to the muscle or nerve which either arouse or aid movement of animal spirits dwelling in the fiber. Thus for muscular movement it will be sufficient by the agreement of all that greater force or a more powerful impetus be communicated to the nervous fluid. Wherefrom it follows that muscle never fails to contract however often swifter movements be impressed on the animal spirits, and the contraction of the muscle is greater in proportion as the impulse of the spirits is greater, since causes correspond to their effects in a constant ratio, and greater effect must follow a greater cause. Let the muscle of a living animal be seized upon, struck, shaken, and compressed by whatever instrument you wish; covered by its integuments it will remain motionless to such blows as you wish and always preserve its native state of relaxation. However, in the drawing up or moving or shaking of the muscle, great indeed must become the impression on the animal spirits which consequently, rushing into the fiber with violent and aroused motion, exert their impetus in every direction. Why, then, even though it be struck by the most fully aroused movement of the spirits, does the muscle grow quiet and persist unmoved? A quietude which indeed cannot fail to turn about and drive to silence those who construe the animal spirits as the *effecting* cause of muscular movements.

IV. Especially if the nervous fluid be set up as the *effecting* cause of muscular contractions, muscles would never grow quiet, never remain motionless, and when once irritated by a stimulus would never again fail to be moved and alternately pass from contraction to relaxation and relaxation to contraction, something opposed to all experience, where we are taught that muscle is voluntarily contracted and soon restored to the original state of relaxation and then remains motionless up to the time when the mind, arbiter of

its movement, commands new contraction of the muscle. In order that this may be most evidently demonstrated it will be enough to take notice, from the precepts of our adversaries themselves, that even the slightest motion of animal spirits is sufficient for the muscle to be maximally contracted. Scarcely with the point of the finest needle or hair or tip of a whisker is the fiber of frog muscle or the substance of an innermost nervelet touched, scarcely is the tiniest drop of water applied or air gently blown on it from the finest tube, when the muscle at once is most violently contracted and even to the most distant joints movement and agitation are propagated. No one can ignore how light and imperceptible must then be the movement of the animal spirits, to hold to the known laws of mechanics. Yet when the muscle is restored all the fibers composing it are stretched out, an innumerable multitude of constricted vessels is unfolded, and all the nervelets pervading the muscular substance are relaxed and expanded with incredible swiftness. How great, therefore, will be the agitation of the most subtle and mobile animal fluid, how enormous the swiftness, how great the vibration aroused! What then? With the first relaxation the muscle grows quiet and lies idle. Truly if for the purpose of contracting the muscle it is sufficient to approach the point of a needle to even its finest filament, then why in the restitution of the muscle is such an impression on innumerable of its filaments not sufficient? If the lightest touch suffices when made by a needle and applied to a single point on the fiber, why will the impression be propagated through all the points, amplitude, and extent of the fiber? Finally, if the slightest contact of a fiber can most violently contract the muscle, then why will not violent agitation, distension, and commotion of all fibers be able to do it? All of which in a single light, as it were, shows more clearly that the animal spirits cannot be the *effecting* cause of muscular movements.

V. I know what allegation might be made against these arguments. Someone could venture to argue against us justly about the difficulty of whether there be constituted in the animal spirits an *effecting* cause as well as also an *exciting* one; we have nothing for which we could take much glory when in our own contention there remains undisclosed the reason for the fact that the lightest contact of fiber can serve to excite instant action of irritability, and yet a more active impulse, more potent force, and stronger impression might be unable to excite it. But this difficulty collapses if the nature, quality, and character of *effecting* and *exciting* causes

is accurately expounded. If nervous fluid is the *effecting* cause of muscular movement, the muscle will have to move just as many times as the determined movement is communicated to the nervous fluid, because in this hypothesis movement of animal spirits is the cause of muscular contractions, and all effects arise from their causes and correspond to them. In all the phenomena of nature we observe the same sequence most consistently, to such an extent that there would be nothing certain and known in universal physics without the light of this principle, and all would be left to the scoffing of the Pyrrhonists*. But in an *exciting* cause this harmony and agreement between effect and cause which we have just indicated is not required; one can be greater than the other; with cause increased the effect can diminish, and at times vanish, since it is not truly and properly a cause, but only the *occasion and instrument of a cause.*

We have a most illuminating example in tickling. Contact of the lightest feather drives a man to fury, tortures, persecutes, and torments him. But let the stroke be continued and the feather moved with some force and effort across the surface of the body and the man grows quiet, ends his agitation, ceases convulsing. It is possible, therefore, for an exciting cause to be continued without the effect being continued, or in fact even continuing to exist at all, and consequently the impetus of the animal spirits and their movement can be accelerated without movement of the muscle and continuation of the contraction. In *exciting* causes it is not so much the intensity of the action which must be continued, but its quality, circumstance, place, and time must be considered, since all will vary the effect and at times even destroy it.

VI. Why is it that paralysed muscles of limbs which have been injured are contracted most violently as soon as they are brought under the influence of the electric spark of an ordinary instrument, a fact which the famous Jallabert observed long ago on a Genoan paralytic, and which in Bologna that man of keenest ingenuity and preeminent learning, Caldani, has repeatedly found? Some would perhaps take recourse to animal spirits residing in the muscle in the paralytic after many years: for some scruple may cling that there be animal spirits in paralytic limbs because of the fact that sense, for the most part, is present. From this scruple I therefore set men free. Crural nerves of frogs I have repeatedly sectioned,

* [Followers of Πυρρον of Ellis, the founder of the Skeptical School and a contemporary of Alexander the Great. *Tr.*]

and then, after a lapse of several days after the section, have irritated the femoral muscles with stimuli and seen them contracted to the utmost. And on goats, lambs, and dogs I have performed the same experiment many times. "Then aren't there spirits in them?", our adversaries will cry. The pun* is over an important point. But we might otherwise be expounding more loquaciously and diffusely on these things. From the above it flows forth spontaneously that the effective cause of muscular movements is most emphatically not to be ascribed to the animal spirits.

VII. In order that the system of irritability may be validly established, the sum of matters stands on this, that from effecting causes of irritability the animal spirits be driven forth and revealed as an exciting cause. The too much neglected demonstration of this truth, even by the Hallerians themselves, brought it about that up to now the mechanists should attribute to nervous juice all the effects of muscular movements; in the truer view it should be accepted as depending on the new property of muscular fiber which with marvelous ingenuity and sagacity the distinguished Haller suspected and with the highest dexterity experimentally confirmed.

VIII. Concerning the manner of its adherence to the aforementioned principles I could freely expand into the widest field of animal economy, and recall certain of the most abstruse phenomena of the living body to simplest principles, and with great fervor and contention lay low all difficulties proposed against the irritability of fiber, but the brevity of the work I have undertaken forbids me to go further. Other meditations in which I shall consider the single phenomena of fiber under one aspect, as it were, and in which I shall expound and bring forth more abundantly the nature of irritable fiber, the laws, and usages, I defer to another time, if there will be enough leisure for me from my affairs that I can take the time more freely for these most agreeable speculations.

[To be concluded]

* Numquid hospitantes Spiritus Adversarii clamabunt? The pun appears to be on "animal spirits" or "spirits" meaning spooks. *Tr.*

Notes and Queries

Edited by Dorothy M. Schullian, Ph.D.*

*The Treatment of Smallpox in Peru in 1589***

In my early days as a specialist in Latin paleography, I traveled in 1907 through Spain photographing medieval MSS. written in the so-called Visigothic hand. This led eventually to a book published by the Connecticut Academy of Arts and Sciences under the title *Collectanea Hispanica*. I had formed friendly relations with Spanish archivists, and cemented them with a gift of a copy of the book to every library in which I had worked. Thus, my being persona grata in Spain was largely responsible for the Smithsonian's choice of me to carry out the Dawes Fund exploration of European archives, in 1929-1931, for unpublished material on American Indian civilizations. This experience led to a similar project in 1952-1954 under the auspices of the Brooklyn Museum, with grants from the Wenner-Gren and Bollingen Foundations and private individuals, in the course of which I came upon this smallpox item. The material gathered on this expedition is in the custody of the Peabody Museum of Harvard University.

On the earlier trip I had found in the Vatican Library the earliest American medical work, a herbal written in Latin in 1552 by two Aztec Indians and published in 1940 by the Johns Hopkins Press as *The Badianus Manuscript*, with introduction, translation, and annotations by Emily Walcott Emmart. I had also come upon considerable material on the prevalence of a syphilitic disease in the Caribbean Islands and Mexico—so much as greatly to interest Sir Henry S. Wellcome, who offered me in 1931 a generous subvention to continue investigations along those lines; he hoped that they might settle the question whether syphilis was brought to Europe by the sailors of Columbus, by the Portuguese from China or India, or had lain dormant since primitive times. I still think that a few years of research by an experienced specialist would at least throw much light on the question, and perhaps lead to its solution.

At any rate what happened in America was an exchange of diseases. The Spaniards caught this bubonic disease (I found a fascinating account of stupefaction by tobacco as a means of deadening the pain), and in turn presented the Indians with various devastating European maladies, of which smallpox was the most deadly. I actually ran across an example of an exact exchange—a Mexican village in which the missionaries found a day set aside for prayer to the Aztec god of syphilis, and consecrated it instead to the saint who granted relief from smallpox.

Much obloquy has been cast on the Spaniards for their treatment of the Indians. One thing they did far better than we: they provided the Indians with hospital care from the start; see the numerous references to "Hospitals" in the index to my Smithsonian edition of Vázquez de Espinosa. I am glad to have this opportunity to give a demonstration of the solicitude of a great sixteenth century Spanish medical authority for the afflicted natives of Peru.

* Cleveland, Ohio.

** Permission to publish, in whole or in part, has been obtained from Director Charles Nagel, Brooklyn Museum, Brooklyn, New York.

The huge MS. 3043 in the Biblioteca Nacional of Madrid is composed of official documents connected with the administration of the Spanish-American colonies, mainly Peru, in the second half of the sixteenth century. It is described in detail in Julián Paz's *Catálogo de MSS de América existentes en la Biblioteca Nacional* (Madrid, 1933) under the number 859. Here is an abstract of the documents dealing with provisions against smallpox, beginning on f.422 of the volume and ending on f.427.

On 21 March 1589, Viceroy Don Ferdinando de Torres y Portugal called a meeting of physicians, namely Dr. Francesco Franco (who, Dr. H. E. Sigerist says, "was a distinguished physician and surgeon, graduate of Montpellier, rector of the Univ. in Lima 1586-1587"), the Licenciado (LL.D) Ximénez, and Dr. Henríquez (all of whom signed the first document), telling them it was notorious that "la enffermedad de viruela y sarampion" was raging in the district of Quito and had already reached the districts of Payta and Trujillo, coming from New Granada (Colombia). Since it appeared to be an "enfermedad contagiosa y peligrosa," he asked them to ascertain if it was present in Lima, and to state how it was to be met. Since it seemed to attack the Indians first, the physicians suggested ordering the corregidores (officials in charge of the natives) to lay in stocks of sugar, raisins, oil, preserves, and barley. They had found no cases yet in the city. Other "regalos" (delicacies) were to be provided, including honey and oil "para medicina." The moment the disease appeared, the Indians were to be withdrawn from work and exposure to the sun, bled (young robust Indians from both arms), and isolated from the wind and especially from their women. If no fever appeared, they were to be well fed with beef, chicken, kid "y otros manjares de buena substancia."

If fever appeared they were to be put in hospitals, town halls, or even churches, where necessary, for their proper care and in order to keep them from infecting others. The corregidores, clerics, and property-owners were to provide men nurses to see that they had proper food and care. No meat was to be given, but instead barley-water with sugar, sugared bread-pap, preserves, raisins, lettuce, bledo (a plant eaten boiled), pumpkin, and quinua (an Alpine cereal whose leaves also are boiled like spinach) where it occurred. These were to be cooked up together and eaten with vinegar, oil, sugar, and a little bread, of maize if possible. The patients were to be kept quiet, but after losing the fever and while convalescing they could be given some meat. The water they drank was to be boiled with barley or raisins or both; wine, chicha (hard liquor), and cold water were forbidden.

Bleeding was to start immediately after the fever began. If the patient was vigorous, he was to be bled three or four times a day for three days, especially if the fever persisted, and even if the eruption began coming out; after the appearance of the eruption, dry cupping was to be used on the shoulders, buttocks, and calves. If constipation occurred, the use of anal injections was recommended ("algunas melezinas comunes por abaxo"), for purges could be administered only with a physician present.

When the eruption appeared, great care was to be exercised to shield patients from the wind and air; sweating was to be encouraged; they were never to drink cold water. The most dangerous accompaniments of the disease were affections of the throat and eyes. Sores might remain in the throat and could be treated with a gargle of barley and raisins boiled together with a pinch of vinegar and sugar and, if available, the juice of "moras" (which means both blackberries and mulberries); if these were not available, milk and sugar might be used. For the eyes, sugar could be dissolved in a little water with plantain or fennel and two "sebritas" (?) of saffron, and the mixture applied to the eyes with a fine feather and white of egg beaten up. If sores remained in the throat, a little alum or copperas could be added to the gargle above. Great care was to be exercised to keep infected Indians from running away and spreading the disease; and well ones were to be prevented from leaving so that nurses would not be lacking.

It was claimed that these precautions and treatments, with the mercy of God, would cure the disease and prevent many deaths. Care was to be taken also that the blankets and shirts of those affected be burned or washed many times in boiling water. And since most Indians were accustomed to sleep on the ground, it was recommended that they sleep instead on platforms raised somewhat above the ground in order to protect them from dampness.

This first document is signed by Dr. Francisco Franco, Dr. Hieronymus Henríquez, and Lic. Ximénez, and countersigned by Mendoça, before Alvaro Ruiz de Nabamuel. There follow directions for the dissemination of these instructions and provisions for the cost to be met from hospital income or community chests; the clergy were to provide spiritual care for the invalids.

The second document begins in f.426 and is headed "Statement sent out from Lima at His Excellency's command, on how in general to cure Spaniards and Indians who have sickened with this pestilent disease which is spreading, known as sarampion or alfombrilla." It is signed in Lima 1 November 1618 by Don Francisco de Borja. It reads:

For the treatment of this disease spreading all over this realm, called sarampion, or by the vulgar alfombrilla, one must watch for the symptoms which usually appear before the eruption. These are coughing and a catarrh running from the head to the chest, pain all over the body, headache, especially aching shoulders, itching, nausea of the stomach and palpitation ("ansias") of the heart, red eyes—and then the high fever. Remember that not all these symptoms are necessary for diagnosis, only some.

It is of the essence to realize that this fever is most serious ("congojoso") and that the blood is greatly heated and of malignant nature, so that aid must be applied carefully and quickly, for while it is true that the majority of those affected get well, with heat there may be a recurrence, so that the treatment should begin as follows:

First food and drink must be considered—water boiled with a little maidenhair fern and roots of borage and chicory; at first before the eruption comes out a few figs or raisins may be added, but after the eruption the water should be boiled only with fresh roots, not with barley, of which I

do not approve. I do not give my reasons so as not to waste time and deviate from my purpose. If these things are not available, broth may be given of chicken, partridge, dove or lamb, and for the very poor, bread-pap ("mazamorra") or what they are used to, but not harmful food like dried beef, bacon, milk foods, and the like; for fruit, native cherries where they occur, pears, cooked peaches for those without appetite; for supper, cooked salads of lettuce, chicory, or borage.

The invalid must be asked if his bowels have moved or his stomach is upset or if he has eaten something he thinks may disagree with him; in such case aid must be given, which is commonly made of mallows or talvina (almond meal), salivated vinegar and honey with a little salt; after this precaution the invalid should be bled from the vena de arca, right arm; if a woman and her period has been irregular or is flowing scantily, first from the ankle. If it is a vigorous young man with a high fever, and the headache or bodily pain persists, he may be bled twice a day, once mornings and once afternoons; if the latter is omitted, on the next day. If the eruption does not appear, and he is sturdy, he may be bled three or four times a day. If the eruption has already appeared and the patient has not been bled, nonetheless he should be bled twice, so that nature may discharge and cast it off better.

From the very first day infusions should be ordered, where there are pharmacies, of maidenhair fern, "violado de laca," citron-peel; in their absence, one may use boiled maidenhair or lentils, or both, with sugar and a little bezoar-stone; morning and night the whole body should be rubbed with a cloth infused with camomile, espliego (a kind of mint), anise or cinnamon or rosemary, and if the headache is severe, use dry cupping; if blood shows, bleed him a couple of times from the uppermost points.

If vomiting occurs, invigorate the mouth of his stomach with oil of wormwood and quinces; lacking these, use the wormwood sprinkled with a little wine and lay it on the stomach. If the vomit is very hot and the stomach much agitated ("ansias"), give him a good drink of rose water. If the bowels move, do not interrupt but insert remedies ("melecinas lavativas") made by boiling barley till the grains burst, and to a bowl of this add a lump of sugar and inject it once or twice according to the need. If the stools are very bloody and the invalid has not been bled much, and is vigorous, bleed him at intervals from the arm and the vena de arca; if the stomach does not quiet down with this treatment, use some mastic powder, with a little of the flesh of a cooked quince, then a medicinal broth of olives, and if it keeps on, astringents. For a child under four, instead of bleeding use wet cupping once or twice as needed; the nurse is to keep his bowels open as in the case of an invalid and give him the food prescribed above, and it is wise in all cases to anoint the eyes with rose water with some filaments of bastard saffron or, failing these, with cold water. Women should be careful to wash their lower parts frequently with rose water or cold water while ill with the disease; where distilled water cannot be had, boil it up with roses or fresh herbs; a pregnant woman should follow the same routine as for a child; to make the birth comfortable ("ttaiga el vientre blando"), she should use a suppository such as the women make of soap or lard, or a point of a radish moistened with oil and salt; if the eruption comes, the treatment should continue as prescribed. If the blotches which come out are black or purple or lead-color, it is a bad sign; if yellow, bad also, but less so; red are the safest. But the best course and most Christian and upright is to have them confess at once when taken sick and have the sacraments administered; then they can feel entirely secure.

The invalids must stay in a sheltered place and not sleep on the ground, which would be the death of many of them. When cured they should stay eight days without exposure to the outer air.

At the top of f.427 is the date 1 November 1618, at the bottom the inscription "For (?) Dr. Juan de Solorzano." The folio contains the following injunctions:

Since this disease of sarampion is general and has got here from the province of Quito, and there is a lack of physicians, especially among the Indians, and it has been learned here by experience that few of those properly treated and cared for have succumbed to what might have felled them, while many of those not so cared for have died, I ordered to have printed the statement and treatment of which I am sending you three copies, so that in conformity with it may be cured and cared for those who may have this disease in that province; it should be distributed to the clerics and persons you may judge most suitable to explain it to the Indians, which is their duty, and if necessary you will print more copies so that they may be spread about everywhere, with your usual care in such matters; likewise the needed funds will be provided by the tomin (⅛ peso ensayado, one "bit") tax for the hospitals, and if that does not suffice, by the community chests. I am sure that this is such a Christian work that you will prosecute it with zeal; I shall rejoice to know how you are doing it. Lima, 1 November 1618. Don Francisco de Borja.

CHARLES UPSON CLARK

A "Facies Leontina" of Leprosy on an Ancient Canaanite Jar

Among the archaeological objects discovered during the excavations of the four Canaanite temples of Beth-shan in Palestine (1925-1926), there is a clay jar which arouses considerable medical interest. The earthenware vessel, of a type used for grain and flour storage in the Near and Middle East from ancient times to our days, has a human head moulded upon it. It was found among sacred and cult objects in a section of the Amenophis III temple which dates back to 1411-1314 B.C. The jar is preserved now (No. P.1806) in the Rockefeller Museum of Antiquities (formerly P.M.A.) in the Old City of Jerusalem.

Alan Rowe in his detailed description of the archaeology of the four Canaanite temples of Beth-shan[1] identified the head on the jar as that of the Egyptian god Bes. On page 57 (Chapter VI, The Cult Objects) we find the following description:

> This jar has a head like that of the dwarf-gods Bes or Ptaḥ-Seker-Osiris. The dwarf reminds one of the figures of dwarfs with which, according to Herodotus, *History*, iii, 37, the Phoenicians ornamented the prows of their boats.

Rowe further draws attention to figures of Bes found on seals and other objects. The other cult objects of clay found in the vicinity of the jar were

[1] Alan Rowe, *The four Canaanite temples of Beth-shan* (Philadelphia, 1940), Part I (Volume II of *Publications of the Palestine Section of the University Museum, University of Pennsylvania*). The jar is reproduced on Plate XLVIa, 3, 4.

doves and serpents, associated probably with the Tamuz-Ashtoreth legend of the decay and revival of vegetation. Sacred boxes and holy vessels were also discovered around the shrine. They were all used in ancient Canaanite agricultural rites.

On looking at the head on this jar, one is impressed immediately by the very great similarity to the "leonine facies" of leprosy. It is a striking face, affected and disfigured by the pathological changes of a progressing disease. The skin has thickened on cheeks and face and has assumed a swollen, loose appearance; the nose is disfigured; the eyebrows bulge and the hair has fallen out from them; the natural lines and folds are strongly exaggerated. All these morphological changes point strongly to a "leonine facies" of lepromatous leprosy.

In considering other diseases which could simulate nodular leprosy of the face, one must mention post-kala-azar leishmaniasis. This can, however, be excluded in our case on epidemiological grounds, since Mediterranean endemic kala-azar affects mainly children, whereas the Indian form which occurs in epidemic as well as endemic forms is seen in all ages, but mostly in adults.

Many authors agree today that the Biblical term "Zaraat," which has been translated as leprosy, includes a number of affections of the skin which may have been of different etiological origin. It is not known, however, whether leprosy is one of the diseases included under this name. To quote R. D. G. Simons[2]:

> Attempts have been made in the past—as in the case of syphilis—to discover the country of origin of leprosy. Investigations of mummies and pictures from Egypt and Asia remained unsatisfactory.

It would appear that the head on the jar from the Beth-shan excavation is an early visual representation of leprosy from Canaanite, pre-Biblical days. We cannot completely answer the question why an awe-inspiring "leonine face" of a leper should be depicted on a clay vessel used for grain storage and found in a shrine among sacred cult objects used in agricultural rites in ancient Canaanite times. It may, however, be assumed that in ancient rites of death and revival of plants and vegetation, in the cult, that is, for protection of the harvest, the terror-inspiring face had a special meaning. One is tempted to quote further from Alan Rowe's treatise (pp. 55-56) a note concerning an allegorical scene on a XIXth Dynasty stela in the British Museum:

> Tammuz . . . and his war-like rival Resheph appear on either side of her [Ashtoreth] . . . Dr. Albright thinks that Resheph corresponds to Nergal, the god of war and of hunting. (In the non-Semitic texts Nergal is sometimes called Ner-unu-gal, "Hero of the Lower World," evidently indicating his connection with death and destruction).

2 Simons, R. D. G., *Handbook of tropical dermatology* (Amsterdam, 1952), vol. I, pp. 465-466.

Fig. 1. Earthenware jar discovered in Amenophis III temple at Beth-shan (Palestine).

Fig. 2. Same photograph enlarged.
Fig. 3. Lepromatous leprosy, from DuBois and van den Berghe, *Diseases of the Warm Climates.* (By kind permission of Grune & Stratton, Inc.)
Fig. 4. Nodular leprosy in an Egyptian, from Manson, *Tropical Diseases.* (By kind permission of Cassell and Company, Ltd.)

It would seem, therefore, if we take into account comparative mythological studies, that the terror-striking head of a leper—the disfigured face of a man punished by the gods—is perhaps depicted on a vessel dedicated for the preservation of crops and harvest with the thought that he may act as protector.

We recall a Biblical story which can be interpreted anew in the light of the archaeological findings at Beth-shan. It is the tale of the four leprous men at the entrance of the gate of Samaria (II Kings, Chapter 6-7). The Biblical narrator recounts in gruesome and appalling detail the great famine that had descended upon Samaria. The besieging army of Ben-hadad, King of Syria, had laid waste the land, and hunger was so great that mothers were eating their children. To the starved population and the skeptical king of Israel the prophet Elisha, Man of God, foretold miraculous deliverance and abundance of grain and flour. We witness in very fact the terror-stricken host of Syria abandoning tents, grain supply, horses, and camp and fleeing before the imaginary noise of a mighty host sent against them by the Lord. We follow the four lepers in their errand through the abandoned camp of Ben-hadad and in their message of deliverance as they bring tidings of great abundance in flour and grain to an unbelieving populace of a starved and beleaguered city. Elisha's prophecy had come true: "It came to pass, as the man of God had spoken to the king saying, two measures of barley for a shekel and a measure of fine flour for a shekel, shall be tomorrow, about this time, in the gate of Samaria."

One can detect woven into the pattern of this tale the threads of a more ancient Egyptian-Canaanite myth which ascribed to the awesome countenance of the leper the power to protect the grain and young harvest and the might to stem famine and pestilence.

M. Yoeli

John Hunter and the Byron Family

In John Hunter's 'Cases in Surgery' (Volume II, p. 115) is recorded "The case of Mr. Chaworth who was stabbed by Lord Byron." The events that led to this incident are as follows. The Lord Byron mentioned here was the fifth Baron who was born in 1722 and succeeded to the title in 1736. His estates in Nottinghamshire adjoined those of his cousin, William Chaworth, great-grandson of Viscount Chaworth. These two gentlemen both belonged to what was known as the Nottinghamshire Club that met once a month at the Star and Garter Tavern in Pall Mall, famous for its choice dinners. At one of these gatherings, on 26 January 1765, John Hewett was chairman and the others present were Lord Byron, the Hon. Thomas Willoughby, Sir Robert Burdett, Frederick Montagu, John Sherwin, Francis Molineux, William Chaworth, George Donstan, and Charles Mellish, Jun. At some point during the dinner the chairman introduced the subject of the best method of preserving game. Mr. Chaworth was of the opinion that the greatest severity should be practised against poachers, but Lord Byron as-

serted that the best way was "to take no care of it at all." The argument became so heated that some of the members tried to change the subject. At the end of the dinner, Lord Byron and his cousin, still at variance, asked to be accommodated with an empty room and apparently before the others were aware what was happening Mr. Chaworth had been stabbed. Mr. Hawkins, sergeant-surgeon to the King, and Mr. Adair, surgeon to the army, were summoned and soon afterwards their patient was removed to 9 Berkeley Street, off Piccadilly, where he had apartments. John Hunter visited him on the next morning and made the following observation in his Case Book: "He had violent vomitings and retchings, but no blood. Pain all over the belly, but complained of none in the stomach. He became weaker, or more and more faint till at last (as he expressed himself) he felt himself dying, and these were the last words he spoke. He died twelve hours after the accident." In Hunter's Book of Dissections is the following entry (p. 107): "What appeared upon opening Mr. Chaworth who was stabbed by Lord Byron. The stomach was wounded, and a tendency for universal inflammation all over the peritoneum both where it covered the Bowels and where it lined the Abdomen."

The coroner's inquest was held at the Green Park Coffee House and on April 16th and 17th Lord Byron appeared before the House of Lords where, by virtue of invoking a Statute of Edward VI, he was acquitted of the charge of manslaughter and was released on payment of a fine. The incident, however, had such a profound effect on him that he spent the rest of his life in seclusion at Newstead Abbey and was known locally as the 'Wicked Lord.'

The reputation of the family was tarnished not only by this affair but also by the indiscretions of Lord Byron's nephew, Captain John Byron, known as 'Mad Jack.' He was one of the handsomest men of his day but so immersed in all the fashionable vices that it was discreditable to be seen in his company. After the death of his first wife in 1784 he became acquainted with Caroline, daughter of George Gordon of Gight in Aberdeenshire, who had a fortune of £23,000, reputed, however, to be much larger. They were married on May 13th in the following year and spent some months in France where most of the dowry was squandered. On their return to England they took up residence in Holles Street where, on 22 January 1788, their son, George Gordon, was born. Within a few days John Hunter was called upon to examine the baby who had a deformed foot. Soon afterwards he inoculated the child and made the following entry in his Case Book (Volume II, p. 3): "On Monday, I inoculated Master Byron in both arms. On the Tuesday the wounds were very much inflamed; also a space round them broader than a halfpenny. This alarmed me as I suspected that it showed too great a disposition for the irritation. On the Wednesday, the surrounding inflammation was gone off, and only that of the wounds; which was less than the preceding day."

Mrs. Byron now decided to leave her husband and she returned to Aberdeen where she managed to live on £150 a year, her only income. John

Byron borrowed money and went to France where he died on 2 August 1791. On May 5th of this year, Mrs. Byron wrote to her sister-in-law, Mrs. Leigh, who was living in Knightsbridge, as follows:

My dear Madam, I received yours some time ago. I am much obliged to you for your kind invitation to France but it will not be possible for me to leave Scotland for some time. I hope by this time you have got your affairs settled to your satisfaction. I hope you will excuse the trouble I am going to give you. It will be doing me a very particular favor if you will send for Mr. Hunter the surgeon and give him the enclosed letter from me. It is about getting a proper shoe for George's foot as I can not get a right one made here. Mr. Hunter some time ago wrote to a Dr. Livingstone giving him directions how it should be made but it never was right made or it would have answered better and as Mr. Hunter saw George when he was born I am in hope he will be able to give directions for a proper shoe to be made without seeing it again. Nothing but want of money prevents my sending him up to London for Mr. Hunter to see his foot as I am perfectly sure he would walk very well if he had a proper shoe and indeed Mr. Hunter said to me that his foot would be very well in time if he had a proper shoe. I will be much obliged to you if you will send for Mr. Hunter and give him my letter and if he should give directions for a shoe to be made for him from what I have wrote him I will be much obliged to you if you will pay the person for it that makes it and send it down to me as soon as it is ready. . . . I would not have put you to the expense of double postage but I do not remember where Mr. Hunter lives. . . . Pray what is going on in the world for I am quite out of it here.

C. Byron.

(British Museum Manuscripts).

Apparently the footwear recommended by Hunter was successful, for in another letter to Mrs. Leigh, written in 1794, Mrs. Byron says that "George walks and runs as well as any other child."

The 'Wicked Lord' died in 1798 and, since his own son and grandson predeceased him, George Gordon Byron succeeded to the title at the age of ten. He was removed from the grammar school in Aberdeen and continued his education at Harrow. While he was yet at school he met and became very fond of Mary Anne Chaworth, thus ending the ill-feeling between the two families that had existed since 1765. Many of Byron's early poems were inspired by Miss Chaworth and he is said to have been much grieved when she married in 1805. But he would never stay at Annesley Hall, her home, "lest the family portraits should descend from their frames to haunt the duellist's heir."

Jessie M. Dobson

Addendum: The Elder Spence and his Extraction Key

In a recent short paper (*J. Hist. Med.* 1955, *10*, 182-196) on Spence and Combe, a dentist and a hack writer, respectively, who were probably useful to John Hunter in his dental work and publications, I mentioned the Spence key, but asserted that I was unaware of anything to connect it with the elder Spence, Hunter's friend, beyond the name. I find, however, that it

was definitely associated with this London practitioner by Sir Frank Colyer in his *Old Instruments Used for Extracting Teeth* (London and New York, Staples Press, 1952, p. 99). Colyer provides the following note:

> In the introduction in Hirsch's 'Practische Bemerkungen über die Krankheiten des Zahnfleischer mit und ohne Entzündung' contributed by Loder the latter on page xi says 'I have seen Spence in London operate incomparably with this key' and on page xiv he remarks 'I do not like the English key which in England bears the name of the "German Key." The great dentist Spence, as he told me, cannot deny that its use is unsatisfactory. Among many alterations of this instrument, which I have in my collection, is one which is praised by this same Mr Spence. He was so kind as to give me for a keep-sake the key which he carried in his bag for ordinary use.'

LLOYD G. STEVENSON

The Salk Vaccine and the Schick Test

In the enthusiasm of the first announcements concerning the Salk vaccine it was pleasant to note that American journalism gave much attention, as in the issue of *The New York Times* for 13 April 1955, to the history of variolation, inoculation, and vaccination in general and to Edward Jenner in particular. It is also pleasant to be reminded that another pioneer in the field of immunization still labors among us. At the age of 77 Dr. Béla Schick continues to serve as chief of the Pediatric Department at Beth-El Hospital in Brooklyn. His contribution to the world of children and the control of diphtheria has been commemorated in the biography by Antoni Gronowicz which was recently issued by Abelard-Schuman.

Vernacular Works in Latin Translation

In the twentieth century, translation is usually from Latin into the vernacular. But from the fifteenth to the nineteenth century the process was often in the opposite direction as a means of guaranteeing international circulation to a remarkable number of works in all fields. An attempt at listing some of these has recently been made by W. Leonard Grant in *Studies in the Renaissance,* edited by William Peery, Austin, University of Texas Press, 1954 (Publications of The Renaissance Society of America, Volume I). Medicine and the allied sciences are treated on pages 142-147. Among the authors mentioned are Marsilio Ficino, Wilhelm Fabritius von Hilden, André du Laurens, René Descartes, George Cheyne, Giacopo di Castro Sarmento, John Freind, Samuel Hahnemann, Paracelsus, and Robert Boyle.

Deutsche Vereinigung für Geschichte der Medizin

The annual meetings of the Deutsche Vereinigung für Geschichte der Medizin, Naturwissenschaft u. Technik e. V. are scheduled for Kassel on 24-28 September 1955.

Maundy Thursday

On 7 April 1955 Queen Elizabeth of England, then in her twenty-ninth year, distributed Maundy money in Southwark Cathedral to twenty-nine men and twenty-nine women. It should be of some slight interest to medical historians that in this traditional rite which commemorates the Last Supper by gifts to the poor she continued another tradition by carrying a nosegay of sweet-smelling herbs, the herbs by which in earlier centuries the sovereign had guarded himself against pestilence and odors.

Pharmacy in the War of Independence

Medicine chests of 1776 are discussed by George Griffenhagen in a preliminary study in the *Journal of the American Pharmaceutical Association* for March, 1955, pages 151-153.

The Library of Dr. Russell L. Haden

In his years at the Kansas University School of Medicine and at the Cleveland Clinic Dr. Russell L. Haden assembled a valued collection of books on the history of microscopy and of hematology. This collection, numbering 238 items, has now gone by the gift of his widow to the Library of the History of Medicine at the Kansas University Medical Center. Dr. Haden died on 26 April 1952. His historical interests were reflected also in his outstanding collection of microscopes and in his services to The John Shaw Billings Club of Cleveland, of which he was Chairman in 1947.

The Schuman Medical Historical Essay Prize

Mr. and Mrs. Henry Schuman of New York offer annually a prize of $250.00 for an original essay written in English, *not to exceed 10,000 words*, on some subject pertaining to the history or philosophy of medicine.

To be eligible, an essay must be written by a doctor of medicine, or of one of the medical sciences, who has taken his or her M.B., M.D., or Ph.D. degree not more than five years prior to submission of the paper. The competition is open to candidates of any country. Essays which have won awards in other contests are not eligible. The prize-winning essay will be published in the *Journal of the History of Medicine*. The judges reserve the right to withhold the prize in any year if no essay is deemed of sufficient merit.

Entries should be submitted on or before 1 May 1956 to Dr. John F. Fulton, Yale University School of Medicine, 333 Cedar Street, New Haven 11, Connecticut, U.S.A.

SCHUMAN PRIZE COMMITTEE

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Book Reviews

A. C. Crombie. *Robert Grosseteste and the Origins of Experimental Science, 1100-1700.* Oxford, at the Clarendon Press, 1953. xii, 369 pp. $7.00.

Reviewed by Henry Guerlac, *Professor of History, Cornell University, Ithaca, New York.*

This is a book of outstanding merit and of fundamental importance for the historian of science. With its clear style, detailed scholarship, and thoughtful interpretation, it is in nearly all respects a model to be studied. Around the great figure of Robert Grosseteste—scientist, philosopher, teacher, and ecclesiastical statesman of the early fourteenth century—Mr. Crombie has woven his account of the development of experimental science in the West down to the time of Galileo. This is no mere biography, and indeed two-thirds of the book is devoted to tracing the influence of Grosseteste upon the important school of English and Continental thinkers who stem from him.

Little is said of Grosseteste's career, for Mr. Crombie is centrally preoccupied with Grosseteste's theory of scientific inquiry, his debt to Aristotle and his scholastic predecessors, and the consequences for the progress of science in the later Middle Ages of the Oxford scholar's methodological writings. Historians of medicine will be especially interested in what Mr. Crombie has to say (pp. 75-81) of Grosseteste's debt to medical writers, and regret that more space has not been devoted to it. What happened to Grosseteste's theory of experimental science, and to the central problems to illustrate it, is admirably set forth in chapters devoted to the work of Roger Bacon, Witelo, and Theodoric of Freiburg, with special attention to their optical researches and their studies of the rainbow.

Ever since the appearance of the pioneer writings of Pierre Duhem, historians of science have devoted close attention to the medieval antecedents of the scientific revolution of the seventeenth century; and although many of Duhem's most extravagant claims have been rejected or refined, we have not wholly freed ourselves from the habit of devaluing, if only by an excessive emphasis upon the medieval pioneers, the undeniably original aspects of this great movement. It is one of the admirable features of Mr. Crombie's book that he never loses sight of the goal towards which science was moving, nor fails to recognize the distinguishing characteristics of the science of Galileo's time.

With convincing skill and great readability Crombie has shown what the methodology of experimental science owes to Grosseteste, and how it was expanded and refined by his successors. Logical analysis of the scientific process clearly emerges as a necessary, but of itself insufficient, condition for the emergence of the New Learning. In this respect little would seem to have been added by the thinkers of the seventeenth century. For as

Crombie writes, the logical structure of scientific inquiry, and the essential methodological problems of experimental science remained in the seventeenth century "basically the same since the beginning of its modern history some four centuries earlier." The Cartesian "Method of Analysis" and even Newton's famous "Rules of Reasoning in Natural Philosophy" add little if anything to what had gone before.

Yet something new had in truth been added, and if Mr. Crombie has not (as it was not his responsibility to do in this work) disengaged the all-important ingredients, he has clearly pointed the way. The interest of Grosseteste and his medieval disciples, he emphasizes, was to ascertain the logical foundations of natural science; the experiments they performed or proposed were designed largely to illustrate their method (as was to be the case of Descartes in his *Discours de la méthode*). What distinguishes the New Experimental Learning was an obsessive interest in the experiments themselves, and in what they could reveal, here and there, of the true course of Nature.

E. P. GOLDSCHMIDT. *The First Cambridge Press in its European Setting.* (The Sanders Lectures in Bibliography 1953). Cambridge, at the University Press, 1955. x, 100 pp. illus. $3.75.

Reviewed by the EDITOR.

As Mr. J. L. Vellekoop points out in the foreword, E. P. Goldschmidt was more a scholar than a bookseller and he was "much more interested in reading and studying the books he sold than in the actual profit he made from their sale." The son of a wealthy Viennese family long interested in books and scholarship, young Goldschmidt had his early education at Cambridge where he came in 1905 to Trinity College and where he devoted his energies largely to the study of incunabula, bookbinding, and the texts of various medieval authors. Of the many books he wrote, his *Medieval texts and their first appearance in print,* published by the Bibliographical Society in 1943, was his favorite piece of writing.

When Mr. Goldschmidt was elected Sanders Reader in Bibliography for 1953, his health was already on the decline, but characteristically he dropped everything else and devoted his remaining energies to the theme that stirred him most, namely, the history of humanism in printing after 1500 as illustrated by the humanistic printers of Cambridge University, and in particular, the curious and colorful character of John Laer of Sieburg who was generally known as John Siberch—the name he adopted when he set up his printing establishment at Cambridge in 1519.

Mr. Goldschmidt was so saturated with the activity of the early humanists in Italy and in France and with the transplantation to England of humanistic thought in the form of the "new learning," that he re-creates in this volume not only the characters involved but the atmosphere in which they worked. I do not know that one would entirely agree with the statement that with the death of Pope Leo X in 1521 the spirit of hu-

manistic enthusiasm departed from Italy; to be sure, it had waned by that time, but Linacre who had caught the flame of Leoniceno earlier and the various scholar-printers such as the Aldines carried the Renaissance well into the sixteenth century in Italy and in England. Mr. Goldschmidt has made Erasmus and Luther live, and he gives credit to the Collegium Trilingue at Louvain which did so much to foster the humanistic movement at that ancient Catholic seat of learning and in Belgium generally.

The book is illustrated with two full-page plates, one a frontispiece showing the superb early English binding of Gaza's *Greek grammar,* and the other, Hans Holbein's inimitable portrait of the printer, Johann Froben. In addition, there are eleven full-page figures illustrating some of Siberch's titles and colophons, and other examples of contemporary printing. The book is also equipped with a full and very useful index.

JOSEPH FRANCIS FLETCHER. *Morals and Medicine. The moral problems of: the patient's right to know the truth, contraception, artificial insemination, sterilization, euthanasia.* With a foreword by Karl Menninger. Princeton, N. J., Princeton University Press, 1954. 253 pp. $4.50.

Reviewed by LEE BUXTON, *Professor of Obstetrics and Gynecology, Yale University School of Medicine.*

AT first glance it would appear as though Joseph Fletcher in his monograph on *Morals and Medicine* has accumulated a disconnected hodge-podge of controversial medical subjects which have no particular relationship to each other. This thought is rapidly dispelled, however, by a realization that the subjects considered by Mr. Fletcher are made intimately cohesive by the age-old problem of the relation of the conscience of the physician to his medical responsibilities. These moral problems which the physician has to face are certainly as old as Aesculapius, and physicians since 400 B.C. have been swearing by the Hippocratic oath that they will assume moral responsibility for their professional activities.

Because of the subject matter of this book, such as contraception, artificial insemination, and so on, the author, who is a Protestant, immediately comes in conflict with Roman Catholic dogma, and in a way this little volume is a dialetic between these two points of view and a powerful apology for the Protestant attitude. Mr. Fletcher repeatedly comments on, and is distressed by, the fact that Catholic theological opinion has been expressed very freely concerning the Catholic physician's attitude toward medical morals, whereas a singular paucity of moral instruction has been passed on by the Protestant clergy to their medical parishioners. This fact is unquestionably true, but this reviewer, also a Protestant, views it as encouraging rather than distressing. In a way, it points up the very essence of the difference between the Catholic and the Protestant approach, and in many other ways, some possibly subconscious, the author repeatedly points out this difference during the interesting and powerful discussions contained within the pages of this book.

It may be said that this basic difference between these two Christian systems of ethics is the basic difference in the relationship of man to his God. The Protestant, through his moral conscience, insists upon the right to deal directly with his God in his own way and is therefore willing to assume the moral responsibility of this freedom of choice. On the other hand, the Catholic is relieved of this moral responsibility so far as he personally is concerned by accepting the dictates of his church. Therefore he deals with his God through the intermediary of the appropriately delegated individuals of the Church of which he is an indissoluble member.

Because of this Protestant belief, there should actually be no Protestant opinion, in any general and dictatorial sense, passed down from various different Protestant authorities to their physicians concerning these very elemental and basic relationships. Rather should it rest with the Protestant physician's conscience and his God as to what decisions he should make.

These two vital differences between the two sects are as they should be. There are different kinds and types of physicians in the world just as there are different varieties and types of individuals in every walk of life, and some of them inevitably find that the sanctuary and moral irresponsibility of allowing their great religious governing body to decide these things for them is really the way they would like to have their medical affairs organized, and this is quite justifiable. On the other hand, there are many other types of physician who are more individualist in their assumption of moral responsibility and therefore prefer the Protestant point of view.

If a man wishes to involve himself more intimately and individually with his own destiny and salvation, it would seem, in America anyway, that that should be his unalienable right. In this respect, I believe the Catholic must realize that his interference in the moral thought of the Protestant is fully as much of a transgression against religious freedom as is the interference of the communist in the process of democratic thought a transgression against political freedom. In that respect, I would say that the only quarrel which Mr. Fletcher and other conscientious Protestants have concerning the attitude of the Catholic church is that it wishes to infringe upon the Protestant physician's freedom of choice concerning the subjects which are discussed by Mr. Fletcher.

That this fact is true could be attested to by most Protestant physicians who have, in the process of carrying on their profession, any relationship with the Catholic church which, of course, most Protestant physicians do have, in one way or another. After all, there are 692 Catholic hospitals in the United States which care for over three million patients per year, most of them non-Catholic, according to Mr. Fletcher. Whether or not Catholic doctrine should be imposed upon these non-Catholics who are patients in Catholic hospitals is a question which Mr. Fletcher extensively discusses and about which there are powerful arguments on both sides. The problem basically may be almost entirely an emotional one and it is dubious whether an emotional problem can be solved by any kind of intellectual approach.

Apart from the discussion of Catholicism versus Protestantism, Mr. Fletcher has many thought-provoking and penetrating viewpoints concerning telling the truth to patients, contraception, artificial insemination, sterilization, and euthanasia. Although he believes basically that the truth should always be told to the patient by the physician, it is doubtful if this is a subject about which a generalization can be made, and also, in specific instances, if anyone but a physician can really understand its implications. I fully appreciate Mr. Fletcher's most intimate association with the care of the sick and of his great, conscientious, and useful service to them and it may seem a little egocentric for a physician to wish to appropriate the right to make decisions in this matter, but these decisions are what identify the perceptive medical humanitarian, and in the last analysis it is only he who really knows his patient. Granted that there are physicians who are not "perspective medical humanitarians," but they should be, and if they are not, they don't deserve to care for the sick. When the basic ultimate welfare and happiness of the patient are concerned, it may be sometimes most inadvisable for him to know the truth, and only the physician can realize this fact. All that is necessary, for instance, is to consider the great power and usefulness of the placebo, a technique of medication which I admit may be sometimes reprehensible. Sometimes, however, this evasion of the truth places a patient back on his feet and makes him a useful member of society, whereas otherwise he might be left a dependent and useless hypochondriac.

Mr. Fletcher presents a powerful case for contraception, sometimes very cleverly using the Catholic arguments against it as assertions in its favor. It seems to me that the Catholic church really must be on very tenuous ground in its championship of one type of contraception, to wit, the rhythm technique, versus other types of contraception, but here again there is such a profound undercurrent of emotion that it is almost impossible to carry on a dispassionate discussion of this subject. Mr. Fletcher's discussion of artificial insemination was possibly the least understanding of the various sections of his book. In some ways, the reviewer was impressed by the fact that many of his statements were more of a psychologically potent argument against donor insemination than for it, and there were also a few somewhat questionable medical facts mentioned within this chapter.

Of sterilization Mr. Fletcher states he believes that compulsory segregation is actually no different from compulsory sterilization, but to the reviewer this does not seem necessarily true because of the inevitable fallability of prediction concerning future offspring. In some cases the physician can almost infallibly predict that a disastrous product will result from the mating of certain types of human individuals, but this is not invariably so and compulsory sterilization of the unfit must be approached with almost the same degree of caution as Mr. Fletcher advises in the approach to euthanasia.

Undoubtedly the most powerful, perceptive, and penetrating chapter in the book is the last one—a discussion of the ethics of personality, morality, nature, and human nature. The contents should be reviewed and digested with great care and thought. They bring a real cohesion to the subjects and opinions in the previous chapters.

The book is most interesting, stimulating, and timely. It deserves to be read by every conscientious physician who is faced with these problems—and indeed, what physician is there who is not forced to confront them almost every day?

G. M. WICKEN, Ed. *Avicenna: Scientist and Philosopher. A Millenary Symposium.* London, Luzac & Company, Ltd., 1952. 128 pp. 15/-.

Reviewed by GEORGE ROSEN, *Professor and Head of the Department of Public Health Education, Columbia University, New York City.*

THIS volume comprises a course of lectures delivered under the auspices of the Faculty of Oriental Languages, between 31 January and 7 March 1951 at the University of Cambridge. The general idea was conceived by Professor A. J. Arberry to mark the Islamic millenary of Avicenna's birth. The success of the lectures suggested publication, and they are now available in a slim volume consisting of six chapters. These comprise the following topics: I. Avicenna: His Life and Times, by A. J. Arberry, II. Avicenna's Place in Arabic Philosophy by J. L. Teicher, III. Some Aspects of Avicenna's Influence on Jewish Thought by E. I. J. Rosenthal, V. Avicenna's Influence on the Mediaeval Scientific Tradition by A. C. Crombie, and VI. Avicenna and Western Thought in the 13th Century by the Reverend Kenelm Foster.

While this volume is directed to all likely to be interested, it is not a series of popular lectures. Indeed, some of the contributors assumed a considerable background of knowledge on the part of auditors and readers. All in all, however, an educated person interested in learning about Avicenna, his life, his work, and his impact on medicine, science, philosophy, and literature will derive a great deal of information and understanding from this book. For those particularly interested in the history of medicine, the sections by Arberry and Crombie are especially pertinent. There is an index.

Ferdinand Sauerbruch—Master Surgeon *(Das war mein Leben).* Fernand G. Renier and Anne Cliff, Trs. New York, Thomas Y. Crowell Company, 1953. 277 pp. $3.50.

Reviewed by GUSTAF E. LINDSKOG, *Professor of Surgery, Yale University School of Medicine.*

THIS autobiography of a world-famous German surgeon was translated from the original entitled, *Das war mein Leben* (Bad Wörishofen, Kindler und Schiermeyer Verlag, 1951) by Fernand G. Renier and Anne Cliff.

Ferdinand Sauerbruch was born at Barmen (now Wuppertal) in 1875; his mother was the daughter of a shoemaker. His father, a minor textile executive and salesman, succumbed when Ferdinand was two years old to pulmonary tuberculosis, the disease which claimed a fair share of the author's professional attention in later life. Sauerbruch's relatively humble origins, and the uncertainties of a fatherless childhood which was dominated by his widowed mother and maternal grandparents, shed considerable light on his character. One comprehends his eagerness for security, his enjoyment of life's material riches, his more than moderate drinking, his admittedly non-Platonic interest in beautiful women, to which he alludes not infrequently and which culminated in a second marriage at the age of 64.

Sauerbruch's decision to study medicine was apparently aroused rather casually by a fellow student. Ferdinand matriculated at Leipzig where he attracted the interest and eventual support of the anatomist, His. Following graduation in 1901 Sauerbruch engaged in practice briefly in small hospitals at Cassel and Erfurt. A naturally curious and challenging mind led him to the preparation of his first scientific article, "Experimental Treatment of Intestinal Laceration after Abdominal Contusions. . . ." This was of sufficient merit to attract the attention of von Mikulicz at Breslau. An invitation to join the hospital staff as voluntary assistant followed. This was without question the decisive moment in Sauerbruch's career of over fifty years in surgery, for it was at Breslau that he began his work in thoracic surgery under the great professor.

Considerable space is devoted in his biography to the development of the negative pressure operating chamber ("Unterdruckskammer"). This awkward and cumbersome solution to the problem of anesthesia control and pulmonary inflation during open thoracotomy was considered by the author as one of his principal achievements. Because it directed attention to the physiological principles involved in open chest surgery, it undoubtedly was important and useful; as a practical device, on the contrary, it was short lived and superseded by the simpler positive pressure insufflation method. Had the young Sauerbruch been a student of medical history, he might have come across the experiments of Vesalius with endotracheal insufflation as recounted in the seventh book of *De Humanis Corpori Fabrica* (1543) or Robert Hooke's revival and clarification of the same principle in the *Philosophical Transactions* (London, October 21, 1667). Be that as it may, Meltzer and Auer redescribed the simpler and practical technique in 1909, only five years after Sauerbruch and his chief, von Mikulicz, demonstrated their negative pressure chamber at a surgical congress in Berlin.

Sauerbruch's increasing surgical abilities and reputation brought an invitation to become Krönlein's successor at Zurich in 1910. Besides the increase in rank and salary, the proximity of the tuberculosis sanatorium center at Davos was a great attraction to him. The turbulent days of World War I found the young professor maintaining his teaching post in a neutral country while acting as consultant for the medical corps of his fatherland!

This extraordinary situation led to one of the most interesting and diverting incidents in the book. On behalf of the German government and after a personal briefing by Kaiser Wilhelm, he undertook a confidential mission to Sofia and Constantinople in order to deliver top secret messages to the Bulgarian king, Ferdinand, and the Turkish sultan. These episodes are set down in rather brief outline, but deserve to be elaborated into a full-length story.

At Zurich, and Munich after 1918, many of the great and near-great of Continental Europe were his patients, some even his friends and confidants. In 1927 he was chosen by the Ministry of Education to occupy a chair of surgery at the University of Berlin. This established him definitely as the senior surgeon in Germany; he could hardly avoid even casual contacts with the official life and leaders of the Third Reich. Geheimrat Sauerbruch takes considerable pains to disclaim any official connection with the Nazi party during its rise and subsequent excesses and relates some rather uncomplimentary anecdotes about several of them. If one can judge from his writing alone, he was deeply devoted and loyal to the old Germany, its cultural traditions, and ideals. For example, his admiration and respect for the aged and ailing Paul von Hindenburg is clearly delineated in a short and excellent chapter. His last visit to the dying Reichspräsident is described in deeply emotional although restrained terms. Sauerbruch admitted having the usual German middle class indifference to the mechanics of government. "I have never understood much about world politics" he wrote, "and even today have not regretted it. . . . In later years, I often had reason to revise my judgments, and privately to admit my ignorance of men and events."

Sauerbruch was no shrinking violet. Some of the apocryphal legends attributed to him are substantiated by his own telling and lend a considerable flavor to this book. At times ruthless and overbearing, he was endowed with boldness and courage and the vision to pioneer, to elaborate by trial and error in the laboratory and clinic many intrathoracic operative procedures which until his day were either unknown or associated with a prohibitive morbidity and mortality. Sauerbruch's professional life spans two world wars; it encompasses the rise and fall of several political régimes. He saw the heyday of German preëminence in science and medicine and was himself a leader. He well deserves, therefore, to be memorialized for future generations. His autobiography only partly suffices for this purpose, his written word testifying as to how complex and controversial was his character. His professional life and works must be studied more objectively for a definitive biography by some capable and disinterested historian.

While the English version of the autobiography is almost a literal translation of the original, certain sections are deleted or rearranged for purposes of brevity. It is almost, but not quite, free of errors. The one most evident concerns Sauerbruch's description of the first cold winter after his move to Berlin. The description of his introduction of ski-joring or horse-

drawn skiing on the frozen Wannsee (pages 416 and 417 of the original edition) seems either to have been misread or misinterpreted by the translators.

ALFONSO BONILLA NAAR. *Precursores de la Cirugía en Colombia.* Bogotá, Ed. Antares, 1954. 185 pp. 50 plates.

Reviewed by JAIME PI-SUNYER, *Medical Director of Winthrop Products, Inc., New York City.*

ON the occasion of the 1954 annual meeting of the International College of Surgeons in Chicago, the Colombian Chapter presented an exhibit on precursors of surgery in the South American Republic. Doctor Bonilla Naar planned the exhibit and now describes in this book the milestones and principal events in the progress of surgery in his country.

Bonilla Naar is a man of wide interests and outstanding activity. A very distinguished parasitologist, associate professor of surgery at the Medical School of the National University in Bogotá, and prolific author of books and papers on diverse subjects, in the last few years he has published several historical studies.

The present book fulfills its purpose and furnishes valuable material for future research. It consists basically of a chronology of the surgical techniques and developments, and a collection of biographies of important surgeons, with well-written background material added for further value. Dr. Bonilla Naar's work is concluded with five chapters by other authors: First laryngeal operation, by Daniel Gutiérrez Arango; History of surgery in Caldas, by Emilio Robledo and José Tomás Henao; Surgery in Antioquia, by José Vicente Maldonado; Evolution of surgery in Cauca, by Pablo García Aguilera; and Surgery in East Antioquia, by J. J. de la Roche and Antonio Mauro Giraldo.

Fifty portraits of prominent surgeons illustrate the text.

Leonardo; Saggi e ricerche. Rome, Istituto Poligrafico dello Stato, 1954. xxv, 604 pp., illus. $30.00.

Reviewed by the EDITOR.

THE Italian national committee appointed to commemorate the fifth centenary of the birth of Leonardo da Vinci has done its work with great thoroughness and preëminent distinction. The large, highly illustrated quarto volume of 604 pages, two thousand copies of which have been printed, was brought out under the general editorship of Achille Marazza with a fine introduction by Francesco Severi and type design by Attilio Rossi.

There are twenty-two papers, but not all the contributors to this composite volume are restricted to Italians. Cecil Gould presents a critique on Leonardo's drawings and a note on the history of the drawings at Windsor

Castle. Magdeleine Hours offers a study of the Leonardo paintings in the Louvre; Ernest Gombrich discusses Leonardo's grotesque heads, and Arthur E. Popham, the dragon-fight. Italian translations of these essays appear at the end of the volume. One of the most interesting contributions is Guido Ucelli's account of the new Museo Nazionale della Scienza e della Tecnica, which contains a vast collection of Leonardo's drawings and mechanical inventions and which aims eventually to exhibit reproductions of everything that Leonardo was known to have put on paper, canvass, and woodblock.

The book is carefully indexed and will be indispensable not only to medical historians but to art museums and art collectors throughout the world.

JOHN RITCHIE. *History of the Laboratory of the Royal College of Physicians of Edinburgh.* Foreword by W. A. Alexander. Edinburgh Royal College of Physicians, 1953. xi, 158 pp., 8 illus. 15/.

Reviewed by DOUGLAS GUTHRIE, *Lecturer on History of Medicine, University of Edinburgh, Scotland.*

DURING a period of over sixty years, the Laboratory was one of the major activities of the Royal College of Physicians, and it was a pioneer venture of which there is every reason to be proud. As a centre for original research and as a laboratory providing pathological reports, the institution achieved a world-wide reputation, and it was most desirable that the story should be placed on record by the last of its distinguished line of Superintendents, Dr. John Ritchie, whose distinction as a medical historian is already well-established. It was rather sad, although perhaps inevitable, that the Laboratory, like so many other voluntary efforts, should come to an end with the advent of the National Health Services, and when the rising cost of maintenance made it impossible to continue. Nevertheless, the splendid achievement will now remain on record as a tribute well deserved, and as an inspiration to all who follow the attractive, if difficult, path of research.

Founded in 1887 "for the prosecution of Original Research," and also "to furnish reports upon such matters as the histology of morbid specimans, etc.," there was the further stipulation "that the annual expenditure should not exceed £650," a sum which was soon to be greatly surpassed in spite of liberal support from the Royal College of Surgeons, the University, and the Carnegie Trustees; and costs mounted until the Laboratory closed its doors in 1950.

From the earliest days, when G. Sims Woodhead was the first Superintendent, the Laboratory was maintained on the widest possible basis, a basis which extended far beyond the bounds of clinical medicine. One of the subjects of research in those days was the life history of the salmon. The diet and nutritional needs of students was another field of study, and the reader who glances over the imposing list of original papers which fills al-

most a third of the book will soon be convinced of the far-reaching scope of the various researches. Each of the eight Superintendents who held office during the sixty years has been a man of high achievement and of attractive personality. While it may be invidious to mention or to single out various names, it may be interesting to recall Noel Paton, who became Professor of Physiology at Glasgow, James Ritchie, a great pioneer of bacteriology, and two Colonels who, after retiring from the Indian Medical Service, gave noteworthy service to the Laboratory. They were W. F. Harvey, a painstaking histologist who built up the "Cabinet Gallery of Tumours," probably a unique collection of its kind, and A. G. McKendrick, an authority on rabies and a mathematician of note, who collaborated with W. O. Kermack, now Professor of Biochemistry at Aberdeen, in a series of statistical studies which are of much value. Even the briefest account of the Laboratory would be incomplete without some reference to the devoted services of J. W. Dawson who, in spite of prolonged ill-health, carried on researches and routine work from 1908 until his lamented death in 1927. His selfless assistance to everyone who sought his help, and his engaging and generous personality had endeared him to all.

The Laboratory has left behind it an impressive legacy of careful and painstaking work. The story of its years is not an easy tale to tell, with such admirable economy of words, but Dr. Ritchie has accomplished his task with elegance and exactitude. His book should be in every medical library, as a model of the writing of history, and as a tribute to a noble effort by a galaxy of able researchers.

WILLIAM J. MALONEY. *George and John Armstrong of Castleton, Two Eighteenth-century Medical Pioneers.* Edinburgh and London, E. & S. Livingstone Ltd., 1954. xii, 116 pp., illus. $4.00.

Reviewed by GENEVIEVE MILLER, *Assistant Professor of Medical History, Western Reserve University, Cleveland, Ohio, and Research Associate of the Cleveland Medical Library.*

THE primary purpose of this work is to rescue from oblivion Dr. George Armstrong, an eighteenth century Scotsman practising in London who was a pioneer of modern pediatrics. The younger brother of John Armstrong, the poet-physician still remembered for his popular poem "The Art of Preserving Health," George Armstrong created the first children's dispensary in the world in 1769, two years after he had published *An Essay on the Diseases Most Fatal to Infants.* His accurate clinical descriptions of various common diseases of children and helpful suggestions for treatment made the work a valuable handbook for the practitioner which went into four editions in sixteen years. However, the publication of Michael Underwood's *Treatise on the Diseases of Children* in 1784, a book largely paraphrased from Armstrong, eclipsed it, and Armstrong's financial difficulties which closed his dispensary in 1781 brought him to an obscure end. Almost en-

tirely neglected by earlier historians of pediatrics, George Armstrong has been convincingly vindicated by the late Dr. William J. Maloney who in a labor of love carried on tireless research to uncover all possible details about Armstrong's personal life and medical activities. When his task was interrupted by death, his partially completed manuscript and notes were skillfully assembled by Mr. F. N. L. Poynter, Librarian of the Wellcome Historical Medical Library, who has added a sympathetic preface about the author.

Because the work is unfinished, its weaknesses should not be over-emphasized. However, I feel that they should be mentioned in an honest appraisal of its contents. One general impression stands out, a rather tragic one—the author's laborious digging has frequently brought forth unimportant minutiae, of little value either for understanding the subjects or their time. In general the work represents an assemblage of raw material rather than the completed task of sifting and interpreting. Both John and George Armstrong remain scraps of data; they rarely emerge as personalities, and neither is truly integrated with the scientific and medical world of eighteenth century London. In discussing George Armstrong's mass experiments to determine the most effective remedies, there was evidently little understanding that such an experimental approach was becoming increasingly common. Similar experiments had been made on children at the Foundling Hospital even earlier in order to test the best method for inoculating the smallpox,[1] and during the same year, 1767, in which Armstrong's book appeared, Dr. William Watson experimented on 74 children in the same hospital with the view of establishing the best preparatory procedure for the operation.[2] One wonders what influence the Foundling Hospital had on the development of interest in pediatrics in the middle of the eighteenth century, and whether the Armstrongs ever had any connection with it. Is it pure coincidence, for example, that the pediatric anthology attributed to John Armstrong, *A Full View of All the Diseases Incident to Children,* was published in 1742, only three years after the creation of the Foundling Hospital in London?

Dr. Maloney was preoccupied with the inability of both George and his brother to obtain a license to practise medicine from the Royal College of Physicians of London. He repeatedly infers that this was a deliberate slight, possibly on account of their Scottish origin, and that they were practising medicine illegally in London, citing the statutes of the College as evidence. He failed to appreciate, however, that the actual licensing procedures of eighteenth century London are very obscure, and that the printed statutes were evidently not taken seriously. A survey of the College *Annals* gives one the impression that a summons to present oneself to be examined by the College and obtain a license was more in the nature of "joining a club" than of obtaining a required legal license to practise. There are

[1] Richard Brooke, "A Letter . . . concerning Inoculation," *Philos. Trans.,* 1751-52, 47, 472, footnote.

[2] William Watson, *An account of a series of experiments, instituted with a view of ascertaining the most successful method of inoculating the small-pox* (London, 1768).

numerous instances of physicians with degrees from foreign universities who declined their summons because of insufficient funds. For example, Dr. Edward Archer, chief physician to the Small-Pox and Inoculation Hospital who obtained his M.D. from Leyden in 1745 and began to practise immediately in London, appeared before the Censors of the College on 5 April 1751 "and excused himself for the present as his Business was not considerable enough to answer the Expence of a Licence."[3] This removes the difficulty which Dr. Maloney had in explaining the support which individual members of the College gave to Armstrong's Dispensary, and particularly the facts that the first home of the Dispensary was furnished by Dr. John Monro, F.R.C.P., and that the list of ten sponsors included three official appointees of the College.

Of especial value is the detailed account Dr. Maloney has given of Armstrong's Dispensary for the Infant Poor where nearly 35,000 children were treated during its twelve-year existence. By piecing together annual reports, subscription drives, and newspaper announcements the author has given a picture of the institution which exists nowhere else. Since it was solely an out-patient institution, the author's designation as "the world's first hospital for children" may be misleading to the hasty reader. It is hoped, however, that these critical remarks will not prejudice the reception of this work by a conscientious author, whose great love for his subject helped to prolong his own painful life so that our knowledge of the early history of pediatrics has been enriched.

EDWIN BURROWS SMITH. *Jean-Sylvain Bailly—Astronomer, Mystic, Revolutionary—1736-1793.* Transactions of the American Philosophical Society, 1954. New series, vol. 44, pt. 4, pp. 427-538. $2.00.

Reviewed by CHARLES GASTEYER, *Instructor in Astronomy, Yale University.*

THIS monograph describes the life of Bailly as a representative of those French philosophers of the Enlightenment who were active during the Revolution. Bailly began his career as an astronomer. In 1760 he set up a small observatory at the Louvre in Paris, equipped with a four-foot meridional transit, a sextant, a pendulum clock, and a small equatorially mounted telescope. He observed several planetary oppositions, eclipses, and the transits of Venus of 1761 and 1769. He reduced a series of lunar observations by Lahire and a catalogue of 515 zodiacal stars observed by his friend and teacher, Lacaille. He published a study of secular changes in Jupiter's orbit and made the first attempt, 1762-1772, to explain gravitationally the motions of Jupiter's four large satellites.

His interests gradually turned to the arts and philosophy. He wrote five *éloges*, 1767-1770, of Charles V, Leibnitz, Corneille, Molière, and Lacaille. In these, he expresses his personal belief in humanitarian rulers,

[3] *M.S. Annals of the Royal College of Physicians*, XI, 102.

stage plays which teach a moral, and in progress and the unity of truth. Bailly wrote a four-volume history of ancient and modern astronomy, 1775-1782, in which he tried to show that astronomy had originated in a lost civilization in central Asia. Later, influenced by Voltaire, he accepted an indigenous origin for Indian astronomy in a book on that subject.

During the 1780's Bailly was a member of several royal commissions which investigated matters of public importance: the explanation of mesmerism; the cause of high mortality in the Hôtel Dieu hospital; establishment of a guild for scientific instrument makers. In these investigations he collaborated with Franklin, Lavoisier, Laplace, and other scientists. In 1789, he was named elector to the Estates General. He was mayor of Paris for two years and in that capacity tried to reform the municipal administration. Difficulties with law enforcement in Revolutionary Paris caused his resignation and later imprisonment and execution during the Terror.

A few errors are noted. Footnote 89, page 445, should add that modern astronomers do not accept a latitudinal variation in refraction. Footnote 102, page 464, should list the Shang Dynasty, which began about 1600 B.C., as the first historical Chinese dynasty. Footnote 2, page 468, should mention Delambre's history of astronomy, which largely superseded Bailly's.

The biographer has described at length the historical background. Full references to the writings of Bailly and others are given in the footnotes. There is an extensive bibliography and index.

J. B. Ullersperger. *Historia de la Psicología y la Psiquiatría en España.* Prólogo, versión, notas y apéndices por el Dr. V. Peset. Editorial Alhambra, S.A., 1954. xxvi, 206 pp. 8 plates.

Reviewed by Jaime Pi-Sunyer, *Medical Director of Winthrop Products, Inc., New York City.*

A physician and adviser of the Duke of Leuchtenburg, Ullersperger, born in 1797 in Munich, author of books on medicine, hygiene, and history, travelled and practised in Spain for several years and became very well acquainted with the country. When in Madrid, he regularly attended the meetings of the Real Academia de Medicina, and in the years of his residence in Valencia, was an active member of the Instituto Médico Valenciano. He read some papers in these societies, mostly on neurology and psychiatry.

Upon his return to Germany, Ullersperger published in 1871 *Die Geschichte der Psychologie und der Psychiatrik in Spanien von den altesten Zeiten bis zur Gegenwart* (Würzburg, A. Stuber's Buchhandlung). Dr. Vicente Peset offers now a translation of the book, complete with a good introduction, historical and critical footnotes, and appendixes on "Three figures of Medical Psychology in the Spanish Renaissance," "Psychiatric Institutions in Spain," and "Spanish Psychiatry in the XIX century."

This book is interesting and rich in valuable data, but difficult reading because of the frequent switch from chronological sequence to description

according to subjects. The original edition is rare at present; the fluent translation by Dr. Peset, with the notes and comments, makes available and frames in the proper perspectives, a document valuable for the study of the history of psychiatry in Spain.

ERICH HINTZSCHE. *Gabriel Gustav Valentin (1810-1883). Versuch einer Bio- und Bibliographie. (Berner Beiträge zur Geschichte der Medizin und der Naturwissenschaften,* Nr. 12) Bern, Verlag Paul Haupt, 1953. 92 pp. Fr. 4.80.

Reviewed by BRUNO KISCH, *Professor of Philosophy and History of Science, Yeshiva University, New York City.*

GABRIEL GUSTAV VALENTIN, pupil of Purkinje in Breslau, and later Professor of Physiology and Anatomy at the University of Bern, Switzerland, is recognized in the literature of the second half of the nineteenth century as one of the leading authorities in European physiology. This reputation was based on his scientific achievements, for example, the discovery (with Purkinje) of the ciliary epithelium in vertebrates, his histological studies on the central nervous system, his discovery of the diastatic function of the pancreas, his basic studies on artificially produced malformations in embryos, and many others. His fame and reputation were also based on his widely known textbooks on physiology, which in the abundance of the material presented and the clearness of the style of his writing were, as his contemporaries expressed it, a revelation to students and scholars. Outstanding in his concept of physiology and medicine was his tendency to approach biological facts by means of physics and mathematics. Even though this earned for him from Du Bois Reymond and others the nickname of Iatro-mathematician, Valentin became through his work one of the fathers of the modern physico-mathematical approach to medical and all biological problems.

Dr. Hintzsche's book is especially valuable because, except for a few short eulogies and biographical remarks from the last century, only one more thorough biographical sketch of Valentin's life and work existed in the English language, and none in German, at the time when this book was published. Erich Hintzsche, Professor of Anatomy in Bern, and in this capacity one of the successors of Valentin in the Chair of Anatomy, is especially well fitted to judge and evaluate Valentin's contributions to the progress of anatomy and physiology. The author has also been well acquainted for many years with the wealth of material preserved in the Burger Bibliothek in Bern, where the entire literary estate of Valentin is treasured. He has made ample use of the opportunity to exploit the information drawn from these sources for his book, which is a fine contribution to the history of medicine in the nineteenth century.

Locke's Travels in France, 1675-1679. As related in his Journals, Correspondence and other papers. Edited with an Introduction and Notes by John Lough. Cambridge, University Press, 1953. lxv, 308 pp. $8.00.

Reviewed by KENNETH MACLEAN, *Professor of English, Victoria College, University of Toronto, Canada.*

THIS bright new volume, which might be called "Locke on Louis," is likely to become a favorite with seventeenth century scholars. In preparing this selection from extensive, and largely unpublished, journals and notes written by Locke during his four-year French sojourn, Mr. Lough has omitted such matters as philosophy (this handled now in volumes by Aaron & Gibb, and by von Leyden) and reading (this reported by Mr. Lough in *Library*, 1953). These and similar large omissions (such as medical notes) leave us with a tight little volume which becomes a part of that epic of France which Mr. Lough knows so well.

Locke's long stay in France began in 1675, after the Oxford days and after early political services to Shaftesbury. He was not well. Mr. Lough uses the word "consumptive." The spelling of proper names in the Journals makes one wonder if illness affected hearing. Certainly colors and tastes were much more a part of Locke's observation than sounds. Locke was now in his middle forties. He was unknown; but he knew himself well enough to know the value to himself of humble, daily observations set down in simple, daily writings. It is hard to conceive of a modern intellectual of mature years taking and keeping such small accounts—timing eclipses like eggs, peering down gun barrels like a boy, looking at dress symbols with the bright eyes of a girl. For their childlike, their Elizabethan closeness to objects, these Journals present an intellectual challenge to moderns. To Bacon himself we shall, of course, ascribe some of Locke's wise passiveness.

Locke's settled days in France were divided rather evenly between Paris in the north and Montpellier in the south. From these two centres he travelled extensively. France has perhaps always done a necessary service for the Englishman by stimulating, however slightly, sympathetic emotion. Locke was moved a good bit by what he saw. Southern France seems particularly to have provided pathetic occasions. Here the Journals rather constantly and rather sadly suggest that one is looking at a Christian world where faith has only imperfectly excluded the old gods from church site and olive grove. On the walls of Aigues-Mortes, from which the medieval crusaders had sailed to the East, we now with Locke see the empty iron rings which tied their ships. And the sea has now withdrawn a sandy league. But history was less moving then the present. Locke wisely used this opportunity to be the sharp and embarrassing observer of the mingled prosperities and poverties of the absolute France of Louis XIV.

These Journals will add greatly to Locke's stature as practical sociologist and economist. And in the illumination of this kind of observation Mr. Lough's editing could not be more helpful. Excellent social annotations—

national and local—accompany this beautifully prepared text. Locke watched very carefully the land tax—the tax evasions of free cities and nobility, the salt making and salt farming, the quartering of troops, the deficit financing. He saw, too, the apparent efficiency of Louis who seemed to be omnipresent—directing the playing of the fountains of Versailles with his cane, putting his name to the smallest hangman's office, directing everywhere his wars. But what Locke chiefly saw in France was an oppressed people and peasantry. Phrases, both sharp and tender, record his sympathy: ". . . people in a deep consumption"; ". . . 5 acres of poverty for one of riches . . ."; walls "rather to keep in poverty than to keep out enemies . . ."; ". . . rot lights on the land." Such conditions were increasingly a matter for attention as this observer stayed on in France. Here is a late sentence. "I saw a Gabeller at the gate serch a litle girle at her entrance, who seemd only to have gon out to see a funerall that was prepareing without the gate, which had drawn thither a great number of people." France rather than England was Locke's chief laboratory of monarchy. It was here that he learned the values of the peaceful freedoms for which he would soon be first spokesman in William's England. One could read a small crisis into these Journals, for there was much for Locke to admire in this France of the sun king, its ever-splendid "uniform" architecture, its Versailles, the Languedoc canal, the new naval town of Rochefort, the new hospitalization of the Invalides, the theatre. Especially to be admired was the new science of Paris, represented in the Académie des Sciences and in the Observatoire (Louis gathered together some of Europe's best astronomers). Locke was very close to the qualities of French science through such men as Justel, Römer, Thoynard, and Bernier. Such attachment is perhaps dramatized in the last entry of these Journals.

Returning home at last, Locke enters no personal emotions as the *Charlotte* comes up the Thames. Rather the Journals record a perverse motion of Thames waves produced by conditions far at sea. This observation is followed by notes on the speedy motion of light, and on Mr. Römer's tinder box—most effective with smallest wax candles dipped in "melted brimstone." The returning Locke was only partially a brand snatched from the burning.

These Journals are, of course, as much a report on Locke himself as on France. In the area of personal interpretation Mr. Lough's editing is less helpful, and understandably so since he is a professor of French literature and not primarily a Locke scholar, and these new Journals present a fascinating and often puzzling picture of the philosopher of sensation, reflection, and ideas. We are greatly interested in Locke's methods of observation. Measuring, pacing, numbering, weighing, cataloguing combine with diagrams and careful instructions to give unusually firm, rational description. One wonders about the intensity of such observation. Is this the climax of the materialism of Locke's Hobbesian phase? Is there some therapy in these attentions? A frank acquaintance felt that Locke's health required something besides travel. Traces of distress lie in small corners of these Journals, and

perhaps an anxiety is suggested in Locke's increasing administration, as amateur doctor, to troubled patients. In his *Essay* Locke will say, in many different ways, that pain is a stronger factor in life than pleasure, and here perhaps in these *Travels* we may see an observation turning slightly towards the sharper object, the salty, the bitter, the fiery. His senses, too, seemed to meet enough ugliness. While Locke is much an admirer of inventions and the new "commodités de la vie" to be seen in France (foodwarmers, etc.), he seems to have sensed a grotesqueness in early mechanical invention, as perhaps in that new life-preserving equipment being tried out in the Seine. He seems, too, to have been addicted to an attention to the offerings of monstrosity, be it the brood of bull and mare, or the Paris water-drinker regurgitating his twenty-five glasses. Locke's senses might be seen to have a certain trouble with a scene from which he will perhaps most gently, most imperceptibly withdraw into the removed world of ideas, words, and imaginative value.

So I think what may finally greatly interest the student in these Journals will be their offering of an evidence (by no means obvious) of Locke's progress towards the world of illusion, idea, symbol, where emotion, meaning, feeling outweigh the outward object. Thinking thus, one will not be bored by the excessive attention Locke gives to the fleeting color world of military parade which Louis was painting on the Paris scene. Religious images were also very much a matter of interest for Locke, especially in Southern France where many days seem to have been occupied in making notes on Catholic ceremony—a Rogation procession, a bishop's funeral, a *Feste Dieu*. Mr. Lough finds Locke constantly critical of Catholicism. At the same time I think we may see in these Journals a concern with Catholic symbolism which was simply intellectual. Mr. Lough is himself somewhat impatient with Locke's repeated visits to Versailles (there were at least five) as these resulted usually in tiresome notes on the fountains. But perhaps if one has a feeling for Locke's own sense of water as an image, one may support his enthusiasm for seeing this essential metaphor blowing itself into such enduring intellectual symbols as arch, pillar, sheaf, pyramid, and bell. The fountains of Versailles were for Locke "spots of time."

And while he was attending to some of the elements of imagination, he was allowing his own spirit to move towards some of the more pleasant human illusions. One such was the pastoral, which seems to have been more fully alive in France in his day than in England. These are Journals of vines and trees and gardens and landscapes. Even French inns sometimes (not always!) helped the rural convention, with candle and fire. There is another strong illusion here. Mr. Lough thinks that Locke was no "monk of Oxford." Yet there are severities in these pages, denials and solitudes, very similar to what may be felt in such a modern mystical journal as that of Mrs. Woolf. Locke never missed the color white, whether in the snow of the Pyrenees, or in trout from Geneva, or in "jully flowers," or in parhelia, or in the order of the Penitent Blancs. Nicest illusion of all for him was the

literary one. And here again we may speak of the humility of Locke. Here in these Journals we see a man in his forties, classically educated, learning to write English! Loving old English words, he spells them oddly, as Mr. Lough's helpful notes show. Only slowly was Locke finding an idiom to suit his very English spirit. "A flock of sheep following the Shepheard apace in the highway."

Mr. Lough sees this traveller rather as the sound "man of the world." But it is also possible to regard Locke as the most delicate of English minds, delicate in a way which will mean much to English life and thought in the century after him. Father Winter, "armed with all his now and iseicles" kept him from getting over into Italy.

> . . . I should be very angry to be thus turnd out of my way when I imagined myself almost at the suburbs of Rome, and made sure in a few days to mount the Capitol, and trace the footsteps of the Scipios and Ceesars; but I am made to know 'tis a bold thing to be projecting of things for to-morrow, and that it is fit such a slight buble as I am should let itself be carried at the phancy of winde and tide without pretending to direct its own motion.

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